APPENDIX B – 2006 FLOOD PUMPING STATION CONDITION ASSESSMENT

1.0 INTRODUCTION

1.1 GENERAL

The majority of the City of Winnipeg Flood Pumping Stations were constructed in the 1950's and the City is now faced with managing the maintenance and rehabilitation/renewal of an aging Flood Pump Station infrastructure. In July 2004, KGS Group was retained to conduct a condition assessment, prepare cost estimates and determine priorities for recommended upgrades. The following components were assessed, for each of the 29 Flood Pumping Stations listed in the City of Winnipeg RFP:

- Building (superstructures, security & site improvements)
- Mechanical (ventilation, piping & pumps)
- Geotechnical (riverbank slope stabilities)
- Structural (substructures & control gates)
- Electrical (power and lighting, distribution and controls)
- Information Management (GIS database, operation & maintenance manuals)

This condition assessment follows previous assessments by KGS Group of the Flood Pump Station reliability (Flood Control Adequacy Review Study, September 2003) and a cursory assessment of the Flood Protection Upgrade requirements following the 1997 Flood (Memo – City of Winnipeg Flood Pump Station, Upgrade Requirements, Capital Cost Estimates, 2004).

The Flood Pumping Stations investigated are permanent stations on the combined sewer systems that function to pump storm water runoff to the river when the river level is high. The long term reliability of these flood pump stations is required to minimize the potential for basement flooding that could occur during periods of high river levels.

1.2 TERMS OF REFERENCE

1.2.1 Overview

The scope of services is based on the Water and Waste Departments RFP, dated March 18, 2004 and consists of the following:

- Condition assessment of 29 City of Winnipeg Flood Pumping Stations as described in Section 12.0 of The Flood Control Adequacy Review Study dated September 2003.
- Recommend upgrade measures resulting from the condition assessment.
- Prioritize the upgrade measures.
- Develop budget estimates for the recommended upgrade measures.

The following Flood Pumping Stations were assessed:

1. Ash, FPS
2. Assiniboine, FPS
3. Aubrey, FPS
4. Baltimore, FPS
5. Bannatyne, FPS
6. Clifton, FPS
7. Cockburn, FPS
8. Colony, FPS
9. Cornish, FPS
10. Despins, FPS
11. Dumoulin, FPS
12. Galt, FPS
13. Hart, FPS
14. Hawthorne, Temporary FPS
15. Jefferson, FPS
16. Jessie, FPS
17. Larchdale, SPS / FPS *
18. La Verendrye, FPS
19. Linden, FPS
20. Mager, FPS
21. Marion, FPS
22. Mayfair, FPS
23. Metcalfe, FPS
24. Mission, FPS
25. Munroe, Temporary FPS *
26. Newton, FPS
27. Polson, FPS
28. Roland, FPS
29. Selkirk, FPS
30. St. John's, FPS
31. Syndicate, FPS
32. Ravelston, LDFPS (Transcona Deep Pond)*

Note: * - Station was removed from scope of work (not a typical flood pumping station)

The location of each of the Flood Pumping Stations considered in this assessment is shown on Drawings 1.1 and 1.2.

1.2.2 Work Scope

The detailed scope of work for each of the work areas assessed is described below:

Ventilation Systems

- Visually inspect and document condition of the existing ventilation systems.
- Prepare recommendations to provide ventilation of the FPS for summer ambient design conditions to provide reliable summer (warm weather) operation.
- Prepare recommendations to address noise concerns related to fan selection, exhaust and intake orientation and sound attenuation devices such as acoustic lining.
- Review man entry requirements below grade (15 air changes per hour)

Piping

- Visually inspect and document the general condition of the existing station process and miscellaneous seal water piping systems.
- Prepare recommendations for painting and/or replacement of miscellaneous seal water piping systems. Should the visual inspection indicate that process piping requires more just than painting, the observations will be documented and recommendations for follow-up steps identified.

Pumps

- Visually inspect and document the general condition of existing pumps in each Flood Pumping Station.
- Prepare a spreadsheet describing each FPS and the approximate range of river levels within which vibration testing can be achieved. A priority list of FPS pumps to be tested will be developed from this assessment.
- Using the FPS Baseline Data spreadsheet and isometric drawing information, define the steps required to prepare each FPS for vibration testing. Meet with WWD to review and finalize test procedure preparations and actual test activities. Resolve unique operational concerns that may arise at a specific station during the testing process.
- Before the minimum river level necessary for vibration testing the targeted FPS is reached, implement the test procedure preparations, including propping the flap gate open, providing access to shaft bearings, etc.
- When the minimum river level necessary for testing is reached, implement vibration testing of each pump in the station. Perform vibration tests for flood pump systems in up to 28 stations (test each pump in the station). A qualified subcontractor will perform installation of vibration sensors and actual vibration testing.

- Obtain a report from the testing subcontractor presenting the vibration baseline test results along with an analysis of these results.

- If operating problems are identified, an assessment of the situation and a follow-up action plan and cost estimate will be prepared.
- Co-ordinate tests with WWD electrical and instrumentation personnel to enable them to conduct concurrent testing of the station electrical components as applicable.

- Prepare a brief report compiling the vibration test results, the analysis report and recommendations for a remedial action plan as required.

Power & Lighting

- Perform qualitative inspection of the condition of the existing lighting, electrical services and controls as part of the Mechanical and Building Condition Assessment.

- Prepare recommendations for minor electrical modifications, such as wiring affected by superstructure repairs or controls related to ventilation equipment upgrades, as required.

- Coordinate costs associated with architectural upgrades requiring removal and reinstallation of electrical equipment on the exterior walls.

Review of Electrical Distribution

Phase 1

- Prepare a spreadsheet listing the breakers at each station so that WWD staff can undertake a field investigation and document the interrupting capacity of the circuit breakers as described on their nameplates.

- Consult with Manitoba Hydro to identify the fault level at each of the stations, with the exception of the five stations currently under design by SNC Lavalin.

- Identify areas where the fault level exceeds the breaker capacity and develop proposed solutions. In general this will consist of replacing the existing breakers with new breakers or fuses of adequate interrupting capacity.

Phase 2 (this work requires that the stations be de-activated and will be completed during Fall / Winter 2005 / 2006)

- Coordinate an inspection and test of circuit breakers at three flood pump stations by Siemens service Department (ITE equipment representatives). The tests would include a visual inspection, review of cleanliness, check of contact resistance and an over current trip test. Two or three breakers would actually be tested with a short circuit.

- On the basis of these tests, an opinion will be reached as to whether the balance of the breakers in all the flood pump stations can be considered to be in an acceptable condition or not.

- An allowance for this item has been carried while investigation is in progress.

Riverbank Slope Stability

- Review all available background geotechnical information for the FPS sites on file at the WWD library and the City of Winnipeg Waterways Authority.
- Visually inspect condition and perform qualitative risk assessment of riverbank stability for all Flood Pump Stations (i.e. classify risk of failure as high, low or minimal).
- Install a slope monitoring system (minimum two slope indicators and three piezometers) to measure bank movements with time at the high-risk sites.
- Perform topographic riverbank survey, including river bottom soundings, at the high-risk sites.
- Monitor slope indicators twice annually, once in the fall and once in the spring (first two inspections only are included in the current cost estimate).
- Perform visual bank inspection plus inspection of the inside of the outfall pipes every second year at the remaining sites (first inspection only is included in the current cost estimate).
- Prepare recommendations for remedial measures and upgrades as required.

Building Superstructure

- Inspect and document condition of the following building components:
  - Wall framing components (wood, masonry, steel)
  - Wall interior sheathing
  - Wall exterior cladding and finish (siding, masonry, stucco, metal cladding)
  - Wall insulation and air/vapour barrier
  - Roof framing components (wood, steel)
  - Roof sheathing or decking (wood, steel)
  - Roof insulation, and air/vapour barrier
  - Ceiling (where appropriate)
  - Roof weather-barrier (shingles, membrane, associated flashing)
  - Roof overhangs and soffits
  - Exterior doors
  - Windows and/or glass block
  - Miscellaneous interior elements as applicable (partitions, hatches)
- Address fire concerns associated with exposed polystyrene insulation in the dry wells where applicable.
- Prepare recommendations for remedial measures and potential exterior aesthetic upgrading options.

Building Site & Security

- Inspect and document condition of existing building site including sidewalks, site drainage, fencing, exterior lighting, general security (vandalism, graffiti, etc.) and safety.

- Prepare recommendations for remedial measures and upgrades as required.

Structural Condition Assessment

Substructures

- Review safety requirements for substructure access.
- Inspect and document condition of existing concrete building foundations, pump wet and dry wells, pump bases and gate chambers.
- Inspect and document condition of existing discharge chamber concrete (wet well), and measure stop log elevation relating to flood protection level.
- Prepare recommendations for remedial measures and upgrades as required.

Control Gates

- Inspect and document condition of existing cast iron flap gates, slide gates, frames, fasteners, embedded thimbles and lifting assemblies, and assess level of corrosion.
- Use feeler gauges to measure any gaps between gate and seating face at various locations around the perimeter.
- Manually lift flap gate to observe hinge operation and to facilitate visual inspection of seating face.
- Manually lower slide gate to observe gate operation.
- Inspect seating face for pitting, coatings or corrosion that may hinder sealing of the gate and inspect slide gate wedges for cracks.
- Document any debris accumulations in the gate chambers.
- Perform qualitative analysis on the extent of deterioration found, and assess the capability of each gate to function safely and effectively.
- Prepare recommendations for remedial measures and upgrades as required.
- Gate leakage tests were not warranted/feasible and therefore were not performed as a part of the condition assessment.

1.2.3 Information Management

Based on discussions with WWD personnel, it was agreed that all of the cost estimate data would initially be compiled in spreadsheet format. The spreadsheets would be prepared in a format readily convertible to a database. Following WWD's review of the costs and proposed implementation scenarios, data base forms would be developed to allow the cost data to be sorted, formatted and printed to best facilitate future planning and implementation. For example, cost forms could be sorted and printed by station, by work area (i.e. building or mechanical) by priority, geographic area or any combination of these sorting parameters.

Monitoring requirements for each of the stations have also initially been compiled in text format. Following review by WWD, these requirements can also be organized in a database to facilitate future coordination of the multidisciplinary ongoing inspections.

BACKGROUND
INFORMATION

2.0 BACKGROUND INFORMATION

Background information associated with this assessment has been divided into, background reference reports and background drawings.

2.1 REFERENCE REPORTS

A list of the reference reports used as background information in the preparation of this report is given in Appendix A. The two primary references used are the preliminary reports, which identified the need and broad scope of work for this condition assessment study. They include:

i) The KGS Group Flood Control Adequacy Review Study and

ii) The 2004 Memo by KGS Group, City of Winnipeg Flood Pump Stations, Upgrade Requirements, Capital Costs.

This 2004 memo was prepared following the 1997 flood to document the projected costs required to upgrade the Flood Pumping Station for a 50 year life extension. The remaining reports referenced in Appendix A were used as background information in the preparation of this document.

2.2 REFERENCE DRAWINGS

A list of all the City of Winnipeg Reference drawings, including the isometric drawings prepared in 2002 for the City of Winnipeg Flood Manual, is also given in Appendix A.

CONDITION
ASSESSMENT

3.0 CONDITION ASSESSMENT SUMMARY

3.1 GENERAL

A summary of condition assessments completed for each of five work areas assessed is given in this section.

- Building and Site (Section 3.2)
- Mechanical (Section 3.3)
- Geotechnical (Section 3.4)
- Substructures and Gates (Section 3.5)
- Electrical (Section 3.6)

Each of these subsections describes the methods used to conduct the condition assessments and provides an overview of the findings of the condition of the station for that work area. The detailed condition assessment sheets, photos and description of the station condition assessment are given in Appendix B for each individual FPS. In each case, a table has been prepared that summarizes the condition assessment finding for each work area.

3.2 BUILDING AND SITE

3.2.1 General

The condition assessments of station buildings and their sites are based primarily on a walk through and close up visual examination of each station. In a small number of stations, where a more detailed examination was warranted, investigative openings were created in walls, ceilings or any other assembly that was suspected of concealing some potentially significant but hidden information, deterioration or condition. These openings were created during the time of the individual site visits by members of the City of Winnipeg Waste and Water Department staff that accompanied the investigative team. These openings were typically made in a location that would not jeopardize the function of the station, usually through sheathing or paneling that could be replaced or patched relatively easily after the investigation.

Of the 29 stations inspected, most station buildings were entirely dedicated to the single function of pumping storm water. Six stations, however, were Combination Stations that include the additional function of the Sewage Pumping Station (SPS). For these six stations effluent is also pumped from within the same building installation. The six Combination Stations include Cockburn (see Photo 3.1), Dumoulin, Linden, Mayfair, Newton and Polson.



Photo 3.1 Cockburn FPS – Combination Station

While many of the other stations had separate sanitary pump station buildings on the same site, these six combination stations buildings were directly connected to the sanitary sewer function, typically accessible through a door or passageway link from within the station drywell or the station building.

Unless noted more specifically, the rating system used throughout the Building and Site sections of the report utilize the words "Good", "Fair" and "Poor". In general the word "Good"

means that the particular item or assembly being assessed was performing well at its intended function, and provided it receives reasonable care and maintenance, should continue to function well for at least the next 10 years. "Fair" typically means that although the item or assembly was still functioning within acceptable limits, major repair or replacement will likely be necessary within the next 10 years. "Poor" generally means that the item requires major repair or replacement. A summary of the building and site condition assessment is given on Table 3.1 for each of components assessed. A description of the assessment results is given in Subsections 3.2.1 to 3.2.5 below. A more detailed discussion of the individual station condition assessments is given in Appendix B.

Assessments of the various items or features affecting safety, such as stairs, ladders and other noted building components, are based on a comparison of existing site conditions with the requirements of current building codes and health and safety regulations. These include the Manitoba Building Code (based on the National Building Code of Canada 1995) and the Workplace Safety and Health Act of Manitoba.

3.2.2 Building Superstructures

General

Of the 29 stations inspected, 28 of them had buildings on them. Hawthorne consists of a below ground gate chamber and FPS. There is a building on top of the adjacent SPS, which houses the electrical for the SPS and FPS.

Refer to the Condition Assessment Summary – Building and Site Table 3.1 for individual station framing, finish, features and general condition information.

Framing Systems

Of the 28 stations with buildings, 19 of them utilized wood construction for the entire superstructure framing (walls and roof). The remaining nine stations were constructed utilizing brick (seven) or concrete block (two) loadbearing masonry for the walls. A variety of systems were utilized for the roof framing, including steel beams and concrete (five), steel trusses,

beams and fluted decking (three) and wood framing (one). All buildings are constructed on top of subsurface concrete drywell structures.

In general, despite the localized dark stained appearance typical of many of the wood framed structures, the wood framing in these buildings tended to be sound. The staining is most likely the result of the regular condensation and frosting cycles occurring during the cold winter months. As the warmer moisture laden air seeps up from the various subsurface chambers below the building, it freezes and/or condenses on the cold interior surfaces of the exterior wall and roof assemblies of the unheated superstructure. Staining tended to be the worst around louvered ventilation openings, as well as around existing and previously in-filled windows. Generally, of the few openings that were cut into some of the walls to investigate potential deterioration due to rot, any damaged areas found tended to be fairly localized with sound adjacent material.

A small number of wood framed stations have reportedly had sections of walls replaced over recent years due to significant moisture problems. One of the worst sites was Polson, where a large section of wall on two sides was replaced with concrete blocks due to rotting (Photo 3.2).



Photo 3.2 Polson FPS – Deteriorated Siding

Polson is a Combination Station with an open flume, which contributes to the problem by continually exposing the station to higher levels of humidity. One of the walls that was replaced, originally included a large window area which is normally one of the greatest sources of condensation from the inside. This area was also exposed to regular roof run-off on the exterior. In addition, these walls were improperly flashed over the concrete discharge blocks that supported them. The investigation revealed a small number of additional stations with localized problems similar to that of Polson that will require repair. These stations include Hart, Linden, Newton, Selkirk, and St. John's.

The masonry stations, utilizing loadbearing brick or concrete block walls and roof structures consisting of steel, concrete, or a combination of both were generally in better condition than the wood framed stations. Not subject to rot, there were no major structural problems at any of these stations. At worst some will require minor localized repair of bricks, and repointing of mortar joints.

Roofing Systems

Four main types of roofing systems were represented at the various stations: conventional built-up roofing with gravel (13), SBS (styrene butadiene styrene) Modified Bitumen membrane (rubberized asphalt membrane with coloured granule face) (seven), asphalt shingles/wood shakes (seven), and prefinished metal (two).

With the exception of Despins all built-up roofs appeared to be relatively old and were generally in fair to poor condition. The roof at Despin was in good condition as it was likely replaced when the station was renovated approximately 10 years ago. All other roofing systems were older and their ages could not be confirmed. Based on the maintenance regime of patching and repairing, it is speculated that some might be the original roofs. With the exception of a few roofs, gravel cover tended to be sufficient but was generally not well bonded and usually full of silt material. Several of these roofs had small amounts of vegetation/moss growing on them. Obviously neglected, the roof at Clifton was littered with branches, and had major bare spots, and considerable vegetation growing in the rain gutters and on the roofing over the discharge block.

The SBS modified bitumen membrane roofs tended to be newer installations and were in good condition. A number of these more recent installations, however, had areas where water could not drain away. As a result of this "ponding", the life of these roofs may be reduced due to the potential effects of freeze/thaw cycling. This could have been avoided by checking roof elevations and providing a nominal layer or section of tapered insulation below the membrane at the time of installation. The Ash station also had a considerable amount of deadfall from surrounding trees.

The condition of the shingle roofs varied from some that were in very good condition to others that should be replaced. The Hart station roof had new shingles on one entire side of the roof and shingles in need of replacement on the other side.

The prefinished metal roof at Cockburn was in good condition (See Photo 3.1).

Eave, overhang, soffit, fascia and trim sizes, configurations, materials and conditions vary widely between stations. In general damage that was found tended to result either from long term deterioration, poor design, neglect, or a combination of each. The worst damage was typically badly deteriorated wood fascias, soffits and rain gutters. Providing appropriate control of roof run-off and maintenance of run-off control systems could have prevented or certainly reduced much of the damage in these areas. Trim on pitched roofs without rain gutters faired reasonably well provided the fascia finish (paint) was well maintained. For roofs with gutters, provided the gutters were not rusted through, damage tended to be worse where gutters and leaders were clogged with debris. The resulting run-off tended to spill over and cause fascia deterioration. Where leaders from gutters or downspouts were either too short or missing the walls below, whether wood or masonry, tended to show evidence of localized damage.

At least one roof hatch used to hoist equipment into and out of the drywell is provided at each station. They are typically constructed with dimensional lumber framing (38 mm x 89 mm joists), sheathed with 19mm wood sheathing and covered with a painted metal pan type flashing. Many are installed overhanging a supporting roof curb so as to provide ventilation. A small number of these hatches, such as at Mayfair, were more sophisticated units constructed of metal. The wooden hatches are typically installed loosely over the roof opening and restrained with at least two hooks and eyes.

Wall Finishes

The predominant exterior wall finish was clay brick (14), then painted wood siding (12), painted brick (one), split-face concrete block (one) and painted stucco (one).

The stations finished with brick are typically either the original exposed loadbearing double wythe brick wall, or a more recently upgraded installation consisting of clay brick veneer covering an original wood frame structure. In general, the brickwork on most stations was found to be in good condition. In addition to normal wear and tear over the years, damage discovered tended to be caused by one of three sources:

- external mechanical damage,
- moisture infiltration and the effects of freeze/thaw cycling
- graffiti removal techniques and/or substances.

Mechanical damage tended to be minor and localized. The major cause of this type was from the recent removal of lean-to Hydro enclosures that have typically left broken brick, holes and marring.

Damage caused by moisture infiltration was typically caused by either the surrounding grade coming in contact with lower brick courses, or the lack of an upstand curb or proper flashing for brick supported directly on the surface of some structure such as a discharge block. In either case, moisture that is on or within the adjacent material is readily absorbed by the porous clay brick. When subjected to the cyclical effects of freeze/thaw, the moisture within it causes the brick to crumble. These cases also tended to be localized. Galt was an example of inappropriate landscaping where the grade level has been built up on one side above the base of the brickwork, but has recently been relandscaped. Jessie is an example of brick being supported directly on a discharge block where a number of faces have spalled off the lower course bricks.

Potentially, the most significant damage incurred may be as a result of dealing with graffiti. Whereas the other causes and effects of damage tend to be localized, correctable and/or preventable, the problem of graffiti is likely to continue. Wanting to maintain the natural appearance of brick, the desired approach is to remove the graffiti from its surface. One

approach used to remove graffiti in the past has been high-pressure washing and other types of material blasting. This has, in some cases, caused noticeable erosion of the brickwork face. Two examples of minor localized blasting are Despin (Photo 3.3) and Roland.



Photo 3.3 Despin FPS – Brick Damage Due to High Pressure Washing

An example of severe blasting is Colony, where large areas of the wall surface is eroded and pitted due to the blasting. When brick is manufactured it is fired in a kiln which results in the brick having a dense protective surface. Over time repeated weathering cycles naturally tend to wear away this surface leaving the less dense and more porous core. Excessive washing pressures or material blasting can erode this protective layer in one session. In addition to changing the aesthetics of the brick, pressure washing tends to wear the bricks more quickly and makes them more susceptible to freeze/thaw damage.

With the exception of localized sections or individual boards, the painted wood siding appears to be original. The siding material itself despite cracked and flaking paint was usually found to be sound. Generally in good shape for its age, most of the siding has been painted so often that repainting has become increasing less effective as a long-term solution. The current approach is reportedly to scrape the loose paint off and repaint. Occasionally the whole building is done, but generally it appeared that in many cases, only the sides that can be seen from the street are painted. As with the brick stations, a number of wood siding stations also have areas of damage and neglect that have resulted from the past inaccessibility and recent removal of the Hydro area enclosures. Although the wood is still generally sound, if it is decided that the wood siding is to remain on some stations, a different approach to painting should be adopted. In order for any repainting of the existing siding to provide a longer lasting and lower maintenance product all existing paint must be stripped and the bare wood painted with a high quality breathable paint system.

The interior surfaces of most wood framed stations consist of unfinished hardboard with tempered face surface nailed over solid wood backing. The loadbearing brick stations are typically unpainted brick, and the loadbearing concrete block station is painted inside. The roof structure in most wood framed stations is exposed wood framing, while exposed, unfinished concrete slabs and painted steel beams are common in the brick stations. There is no requirement for finishing on the interiors of the stations.

Doors and Windows

The wood doors and frames on the majority of stations appear to be original. Most show considerable wear and tear due to normal use, abuse and weathering. The frames on a small number of these stations are rotten near the bottom. Eight of the newer or more recently renovated stations are fitted with insulated steel doors in pressed steel frames. All doors and frames, whether wood or steel, are painted. Much of the hardware on many of the original wood doors appears to be original. Hardware on the new metal doors often includes an exit device.

Over the years, windows have been gradually phased out of most stations. In the recently renovated stations windows have been in-filled and covered over with brick on the exterior. On other stations, window openings have been filled in with painted plywood panels. Only seven

stations still have some type of glazing. Most of these are glass block, which require localized repointing of joints. Windows generally appear to be areas of greater moisture staining on the interior and deterioration on the exterior due to rotting frames.

3.2.3 Interior Features / Safety Issues

General

Part 9, "Housing and Small Buildings", of the current Manitoba Building Code (based on the 1995 National Building Code of Canada) and the Workplace Safety and Health Act of Manitoba were used in this section as the standards for any building code and safety requirements noted below. Although the stations were likely built to the standards of their day, there now exist some discrepancies between existing conditions and the requirements of current building codes and safety regulations.

Upgrading of pre-existing conditions or components that do not comply with newer codes is not normally required. However Building Authorities have, in the past, required code and/or safety upgrades where a building was subject to a change in function (use and occupancy), was enlarged in area, or was subjected to a major renovation or upgrade. Subsequent changes after construction that affect the original design conditions of a building or its components, such as reducing hand clearance at stair handrails and toe clearance at fixed ladders, or adding unprotected flammable insulation, are potentially subject to enforcement of corrective or compensating measures, or restoration of the building back to original design and construction conditions.

Stairs

Stairs referred to in this section are typically those stairs and associated landings that provide access to the drywell areas. These vary in construction and configuration to suit individual station requirements and spatial limitations. In general most stairs are constructed using galvanized steel channels or plate for stair stringers, galvanized steel grating and/or checker plate for stair treads and landings, and galvanized steel pipe and/or angles for handrails.

In general, stairs are provided in the rectangular shaped drywells, whereas in cylindrical drywells ladders are provided. Where stairs are provided, the maximum width is approximately 600mm. Stair inclinations (determined by the ratio of rise over run) vary from station to station. From shallowest to steepest the rise/run ratios vary from approximately 230 mm/200 mm to approximately 300 mm/125 mm. There are no limitations for rise/run dimensions imposed by the current building code for stairs providing access to service rooms or service spaces. Many installations are steep and appropriate caution must be exercised.

All stairs and landings accessing the drywell areas are typically provided with handrails. The construction and heights vary between stations. In general, most handrails at stairs were found to be adequate. Handrails (or guardrails) at intermediate landings did not normally comply with current code requirements. The height of the top rail of guardrails at most landings was only 900 mm (approx.) instead of the 1070 mm presently required.

The building code allows for some discretion in regards to openings through guardrails. Many guardrails only provide a top rail. According to the current code requirements, unless it can be shown that larger openings do not represent a hazard, openings shall not permit the passage of a spherical object with a diameter greater than 200 mm. The industry standard for guardrails in most industrial facilities consist of a top rail and a mid height rail which typically have a space of approximately 450 mm between them. Where slipping or the risk of falling objects is present a 100mm high kick plate is also included at the floor level.

In addition, handrails in most stations lacked sufficient hand clearance along walls and at floor openings where foamed plastic insulation had been installed. In some cases, the normal use of a section of railing was impossible (along a wall), but in many cases the use of the handrail was interrupted for at least a short distance (at a floor opening). With stairs that are as steep, as many of them are, it is particularly important that the handrails be graspable in a continuous manner for their complete length.

Ladders

Ladders referred to in this section are typically those fixed ladders and associated platforms that provide access to the drywell areas. These vary in construction and configuration to suit

individual station requirements and spatial limitations. In general, most ladders are constructed using galvanized steel plate and rods for ladder and cage components, galvanized steel grating and/or checker plate for platforms, and galvanized steel pipe and/or angles for handrails. Ladders and/or rungs used to access other chambers are discussed in another section.

The design of fixed ladders is under the jurisdiction of Manitoba Workplace Health and Safety, which requires that all fixed ladder installations conform to ANSI A14.3 "Safety Requirements for Fixed Ladders".

The actual ladder part of the access system was generally found to be in reasonable conformance with the ANSI standard. The main exception was the spacing of the rungs from the wall (toe clearance). This was often approximately 150 mm, instead of the 180 mm currently required. Insufficient toe clearance was further reduced to approximately 100 mm near the top of the drywell at the foamed plastic insulation lining the walls.

In most cases where a safety cage was provided around the ladder due to its height, the cage did not meet current standards. Manitoba Workplace Health and Safety requires that all fixed ladders extending more than 5 m be provided with a safety cage or a harness type fall protection device. Most existing cages had only three vertical bars spaced at approximately 90 degrees around the cage instead of the seven vertical bars spaced at 40 degrees as required by the ANSI standard.

Guardrails

Guardrails referred to in this section are typically those guardrails that are provided around equipment access openings in the main floor of the building. These vary in construction and configuration to suit individual station requirements and spatial limitations. In general, most guardrails are constructed using steel pipe. Most guardrails were permanently installed although some stations had removable rails that are stored on site until the hatch covering the opening is removed. Most guardrails included a top and mid height rail.

Not all stations had guardrails and some had rails around only some of their equipment openings. Where fixed or dedicated removable rails are not provided, temporary guards are

typically brought in by maintenance personnel and are placed around opened equipment openings for the duration of the particular maintenance operation.

Floor Hatches

Floor hatches closing in equipment and access openings in the building floor over the drywell areas vary in size and construction. The most common hatch construction types are laminated or framed lumber with a plywood surface. This type usually includes recessed metal lifting lugs. The next most common type is precast concrete planking. In both cases, hatches were typically covered with foamed plastic insulation on the drywell side.

Other types of hatches typically located over wet wells, valve chambers or discharge blocks, typically include aluminum or galvanized checker plate, and cast iron manhole covers.

The main concern with these hatches, particularly the wooden ones, is their structural adequacy. Many appeared to utilize pressure treated wood and/or plywood. Since the interior hatches were covered with foamed plastic insulation on their underside, a complete examination and assessment regarding their design, construction and condition could not be done. Because they are floor hatches, these components should be capable of supporting the same design load as required of the surrounding building floor. If not, guardrails should prevent access over these areas and caution signs should be posted.

Foamed Plastic Insulation

Exposed foamed plastic insulation is utilized in 28 of the stations on the interior surfaces at the top of the drywell structures and in some combined sanitary chambers, to minimize condensation and formation of frost on these surfaces during the winter months. The insulation used in most stations is 50 mm thick shiplapped extruded polystyrene (Styrofoam) although some expanded polystyrene was also noted in some localized areas in a few of the stations. Each 610 mm x 2 440 mm insulation panel is typically secured to the concrete structure with eight plastic or nylon headed anchors. The service provided is desirable and the current insulation material is reportedly quite effective at fulfilling its intended purpose of minimizing frost and condensation in the drywell.

The primary safety concern regarding the presence of this material is due to its combustibility and high Flame Spread Rating. The material is highly combustible, and when ignited, fire could spread quickly across unprotected panels. Once burning, in addition to consuming oxygen and producing smoke, the material tends to melt, dropping flaming streams to areas below. A secondary safety concern is the localized reduction or elimination in hand clearance at stair handrails and localized reduction in toe clearance at ladders.

The current Manitoba Building Code requires that where this type of material forms part of a wall or ceiling assembly, it must be protected from adjacent spaces in the building with one of a number of protective finishes or materials. These include plaster, gypsum based panels, a variety of wood based panels (plywood, hardboard, etc.), sheet metal, or any thermal barrier that meets the requirements of classification B when tested in conformance with CAN4-S124-M.

In the approximately 10 years that the insulation has been in place no incident of the insulation being ignited has been reported. Due to its relatively remote location at the top of the drywell and the generally unmanned nature of the station's function, one might argue that it does not present enough of a hazard to warrant the protection required by the code. Nonetheless, ignition could conceivably occur due to any number of operational and maintenance functions. In addition to being fully exposed on its underside, the insulation is likewise exposed from the top at most motor bases. Any function or act introducing a concentrated heat source near the material, such as an electrical malfunction, grinding or welding operation, smoking, etc. could potentially ignite it.

To deal with this issue a number of options exist. They are as follows:

1. Remove the insulation and do not replace it and contend with frost and condensation in another way.

2. Remove the insulation and replace it with a product that is inflammable.

3. Protect the existing insulation, or parts of it, with one of the code required coverings that would be appropriate for the environmental conditions present in the drywell.

4. Leave the existing insulation and instruct personnel in regards to its potential hazard, and provide necessary equipment such as suitable and strategically mounted fire extinguishers to deal with a potential fire should it occur.

3.2.4 Building Site and Security

Site Paving

Site paving varies between stations from none at all to considerable paving areas including drives, curbs, and sidewalks. In general, the access ways, whether formal paved driveways or overgrown gravel path, were sufficient in function and condition. Aesthetically, the gravel driveways in some of the north end residential stations lagged below the current standard and provision of most adjacent neighbouring properties.

Site Drainage

Site drainage was assessed visually for all station building sites. The two main aspects regarding site drainage that were assessed were the height of the main floor of the building relative to the surrounding grade, and the general drainage conditions around the immediate perimeter of the building.

The height of the main floor relative to the surrounding grade helps to determine whether there is a concern with potential local overland flooding, and in some cases it also had noticeable effects on the condition and long-term performance of perimeter building materials and assemblies. The height of the main floor varied widely between stations, from approximately 300 mm below grade at Selkirk (Photo 3.4) to 800 mm above grade at Despin.



Photo 3.4 Selkirk FPS - Site Grading

Most stations were comfortably above grade but a number of stations were at or near grade level. At some of the stations that were at or near grade, damage included spalling brick and rotted siding. Damage of this nature tended to be limited to areas that were at grade or where the grade was slightly above the main floor. It appeared that although they may have been placed high enough when originally built, over time the grade around some of the stations had been built up due to adjustments in municipal grade level elevations, gradual build up of gravel drives, and in some cases, inappropriate landscaping.

Site drainage conditions around the perimeters also varied widely between stations. This aspect deals primarily with the slope of the grade around the building, and whether it tends to shed water away from the building or divert it towards the building. Most stations had reasonable drainage away from the building, many were relatively flat around the building, and some had backslope or local settling that tended to collect water at the building in localized areas.

Although a number of stations were at or just above grade and/or the drainage patterns around the station were poor, there were no reports of chronic flooding of station buildings or excessive drainage related damage or deterioration to the structures.

Fencing

Fencing types, sizes, extents and functions varied widely between stations. Less than half of all stations had fencing of some kind. Although most fence installations appear to have originally had some type of security or property definition function, few seem to serve a real purpose. A few fences are purely decorative. Security fencing is discussed below.

General Security and Vandalism

Other than the commercial grade locksets or exit devices on the newer or renovated stations, most stations have hasps or slidebolts with padlocks on the access doors. Few other security measures are taken to deter unauthorized entry of the stations. The lack of more sophisticated security and the relatively small number of break-ins would suggest that this has not been a significant problem. Although most station buildings are not protected against break-ins with sophisticated or even heavy duty locks, the trend has been to provide better locks as individual stations are upgraded and/or doors are replaced.

The Baltimore station building is completely surrounded by a chainlink fence with barbed wire as shown on Photo 3.5 below.



Photo 3.5 Baltimore FPS – Chainlink Fencing

A number of other stations have partial chainlink fence enclosures around parts of the building or around isolated equipment or other structural installations. Most stations have no fencing, or the fencing that is provided does not prevent entry to the building area.

Site lighting varies widely between stations. Most stations have little or no additional lighting. Others are quite well lit with multiple building mounted fixtures and site or street lighting. Generally, well designed site and building lighting can be a deterrent to loitering and vandalism during the night. In some instances however, harsh or indiscriminately directed lighting installed as a deterrent may become an unwanted nuisance, particularly to a residential neighbour.

Evidence or reports of bolder more dramatic types of vandalism at the stations are rare. At Selkirk the chainlink fence enclosing the rear and side of the station was cut and a number of large aluminum checker plate access hatch covers were stolen and reportedly sold for scrap

value. Cockburn was damaged by arson approximately 10 years ago. St. John's was recently damaged by arson. A number of stations have been broken into over the years. By far, the most common type of vandalism affecting most of the stations is graffiti. Other than those stations recently repainted by the City maintenance forces or the City Graffiti Control, very few stations did not have some evidence of at least a minor occurrence. Another related problem is that of youths regularly crawling up on to some of the station roofs and placing themselves at risk, in addition to causing intentional or unintentional damage. Graffiti and other related issues at a number of the stations have tended to be "seasonal" in nature (i.e. for many years it might be a regular problem at a particular station, and then not at all for the next number of years).

It is difficult to quantify the overall benefit of fencing or lighting as a deterrent to vandalism. At Selkirk the chainlink fence enclosing the rear and side of the station did little to deter the stealing of the checker plate access hatch covers. Fencing, particularly of the enclosing type, has tended to create a related problem in regards to property upkeep, evidenced by tall grass and weeds within some of these enclosures. Many of the stations that are reasonably well lit are still covered regularly with graffiti while others that have little or no lighting or any other obvious deterrents may be free of occurrences. Those stations that tended to fair best were stations that were either remote or surrounded by watchful neighbours. After the Cockburn fire, a station that was prone to problems with youth gathering on the side discharge block and building roof, the discharge blocks were enclosed with masonry walls and a sloped metal roof was installed. There have been few problems at this station since.

3.2.5 Aesthetic Upgrading of building exteriors

General

Due to a combination of the age of the station buildings, changing trends in building styles, neighbourhood development, and functional requirements, a number of the stations require an exterior aesthetic upgrade.

Aesthetically, some of the stations are either well worn or appear out of place in the surrounding neighbourhood that has either developed or changed in style and appearance over the years. Some stations require a major aesthetic upgrading due to their prominent location within the

city, particularly those within highly developed or tourism areas such as the Downtown. Galt had been scheduled for and was completely renovated within the period of this study. Bannatyne is also scheduled for and awaits a similar renovation. Others stations are located in less traveled residential neighborhoods where they have become unattractive due to changing styles and/or neglect. In these locations, although often very visible, albeit to a lesser degree than a downtown station, a less extensive approach would likely be quite acceptable.

The main change in functional requirement is that of the Combination Stations and the desirability to provide a formal separation between the flood pumping area and the sanitary sewer area. This would likely affect the configuration of those stations and is discussed in more detail in the following section. Another functional consideration is the attempt to reduce the regular maintenance requirements of the buildings and their sites.

Aesthetic Upgrade Considerations

In determining suitable recommendations for the aesthetic upgrading of any given station the four following aspects were considered:

- Aesthetics – This deals with the general appearance of the station, whether attempting to blend in with the surrounding neighbourhood such as in residential areas, or becoming a feature or landmark for stations that are highly visible and located in well developed commercial/tourism areas. This involves the consideration of both general station configuration (shape, size, proportions, etc.), and the choice of external building facing materials with their particular textures and colours.

- Maintenance Requirements – Where possible and practical a station that is the subject of a moderate or extensive upgrading should be renovated with materials that reduce maintenance requirements. Even stations that are not the subject of a general upgrade could be upgraded in a localized area as required.

- Resistance to Vandalism (more specifically graffiti) – To minimize the likelihood of and/or effect of graffiti, and to facilitate the removal of graffiti or restoration of surface by overpainting or the like. In general there was little physical damage due to vandalism. The most common and reoccurring problem was graffiti.

- Cost – In general, given extensive or moderate upgrade requirements, cost becomes the factor of determining overall value when considering and comparing capital cost and long term functional and performance characteristics of possible solutions.

Wall Construction

The existing exterior wall material/finish for the majority of stations generally fell into one of two categories:

- Painted wood siding (12 stations)
- Exposed clay brick (no additional finish) (13 stations) – These stations were either recently renovated in high profile areas with new brick veneer or existing brick stations. Jesse which is particularly prone to graffiti has brick that has been completely painted over (Photo 3.6). Mager was painted stucco and Galt was split face concrete block.



Photo 3.6 Jessie FPS – White Paint Over Brick

The walls present a variety of challenges. Due to their surface area the walls have a considerable effect on the appearance of the building. They are also most susceptible to physical damage and graffiti. The solution to the graffiti problem on wood siding has been to

paint over it. In general, this is likely the easiest and most cost-effective solution. But due to the number of paint layers on the siding (from regularly scheduled repainting and graffiti control), cracking and flaking of the paint finish is the main reason for a poor rating on most of these stations. Considering its age, the wood siding is generally in good condition. But unless all of the paint is stripped off and repainted with a suitable breathable paint system, the siding will require increasingly frequent patching and painting to maintain a reasonable appearance.

A number of materials and finish systems are available, each presenting potential advantages and disadvantages. Finish materials to be considered include:

- Vinyl or prefinished metal siding –Visually acceptable for residential areas and somewhat resistant to mechanical damage. Difficult if not impossible to refinish after graffiti, replacement likely required. Questionable long term availability of profiles and colours for future repair/replacement requirements. Lowest cost.

- Painted wood siding or paneling – Visually acceptable for residential areas and reasonably resistant to mechanical damage. Easy to refinish after graffiti. Requires repainting approximately every 10 years. Lower to medium cost.

- Stucco (conventional or acrylic) – Depending on design generally acceptable aesthetics for residential and industrial areas, generally resistant to mechanical damage. Acrylic stucco available in a variety of colours. Would require painting or refinishing (for coloured acrylic) after graffiti. Lower to medium cost.

- Concrete block/brick – Either smooth or split face designs, preferably unfinished natural multi-tone architectural units. Depending on design generally acceptable aesthetics for residential and industrial areas. Is generally resistant to mechanical damage. Repaintable after graffiti. Once painted it would require repainting approximately every 10 years. Could require costly support at base depending on station foundation. Medium to high cost.

- Clay face brick and/or natural stone – Depending on design generally acceptable for all areas. Good long lasting aesthetic qualities and generally resistant to mechanical damage. Requires careful specialized cleaning after graffiti and is often not completely effective - high pressure washing or blasting as done on some stations has resulted in damage to brick face, and painting over is undesirable. Could require costly support at base depending on station foundation. Highest cost.

Miscellaneous Trim

Doors and door frames whether wood or steel will still require regular painting.

Removal of the windows or glass block panels that remain in a few of the stations would be desirable. This would eliminate one area of regular required maintenance. The windows and glass blocks are targets for vandalism and the walls below these units are often subject to deterioration due to water infiltration and build-up of condensation.

Exposed roof components such as fascias, soffits, rain gutters and leaders and similar trim could be replaced with prefinished galvanized steel. This would provide suitable aesthetic and maintenance characteristics at a reasonable cost. These areas are not normally affected by graffiti.

Graffiti Management

In addition to material and finish upgrading, anti-graffiti coatings could also be researched to determine if there would be any advantage to using such a product to ease removal as opposed to covering the graffiti with more paint. Preliminary research indicates that although numerous products claiming successful performance in graffiti management are available, most require frequent reapplication and yield real world results that are less than those advertised.

3.2.6 Combination Stations and Humidity Control

General

With the exception of Mayfair which was designed and built as a fully insulated, heated, and ventilated facility, all other stations are subject to the effects of condensation and frosting during the colder months. The effects range from as little as moisture staining on interior surfaces, to the regular freezing shut of exterior doors, to contributing to rot and deterioration of the building envelope assemblies, particularly in some of the wood framed stations. Depending on the configuration of the individual station, moisture in the form of humid air seeps into the building from various sources. These include the drywell, the wet well, valve and stop log chambers, and combined sewer chambers.

In most cases, the effects have been limited to moisture staining on some of the interior surfaces of the station. Of these, the areas most affected in this way have tended to be at and

below existing or previous window installations and immediately adjacent to louvers and other ventilation openings. At the Combination Stations, particularly some of the wood framed ones, such as Linden, Newton and Polson, the effects have been more intensified due primarily to the additional moisture contributed by the connected sanitary sewer chambers. In these stations there has tended to be greater and more frequent deterioration of building assemblies and greater corrosion of ferrous fixtures and equipment components. In addition, the air quality in terms of undesirable odour tends to be poorer than in most of the other stations.

Options

Since the total physical separation of the flood pumping and sanitary sewer functions is not viable at this point, two other options to reduce the discussed effects remain. Common to both options would be to separate the ventilation systems to reduce the flow of warm moist air from the sanitary area into the pumping station side (see mechanical).

The first option would be to provide a proper separation between the flood pump station and the sanitary station. This would include the installation of a well sealed corrosion proof door in the passageway between the two areas (some stations have existing doors that would be replaced).

The second option would be to provide a separate entrance to the sanitary pumping station. This would include the in-filling of the current doorway or passageway between the two areas, thus reducing the effects of one on the other.

Due to their unique configurations the creation of a separate entry into the sanitary sewer area would likewise be unique at each such station. At the Cockburn station, it would likely involve the construction of a small entry addition to the north side. The existing access pit and ladder could be reworked, and the area separated from the remainder of the building such that access to the existing drywell would remain unchanged and access to the sanitary area would be from the new north entry.

At the Dumoulin, Linden, Newton and Polson stations, the creation of a separate entrance into the sanitary sewer areas would likely involve the construction of a somewhat larger addition to the front or side of the station as appropriate, complete with a new stair or other access directly

down through the top of the upper sanitary sewer chamber roof. City of Winnipeg zoning yard requirements, (spatial, functional, access, aesthetics), and other requirements would all have to be considered and studied to be accommodated into the final designs. The amount given in the cost summaries for this item should be considered as allowances that are subject to change dependant on satisfying the various requirements listed above.

The Mayfair station was designed to accommodate the coexistence of the flood pumping and sanitary sewer functions and does not require modification.

3.3 MECHANICAL

3.3.1 General

Inspection Methodology

The mechanical component condition assessment has been evaluated based on field observation and Flood Pumping Station (FPS) data acquired through the following sources:

1. Site inspection of all FPS in August/September 2004.
2. Vibration testing (Appendix C) and thermal scanning (Appendix D) performed on 17 out of 28 FPS in fall 2004 – spring 2005.
3. Ultrasonic testing of flood pump piping on Dumoulin, Jessie, Linden and Newton FPS in January 2005 (Appendix E).
4. Discussion with City of Winnipeg Water & Waste Dept. personnel.
5. Review of archival Water & Waste Department engineering drawings.

Once all information was compiled, qualitative observations were reviewed and several mechanical components were assigned a relative rating based on scales as described later in this Section. The scales utilized have been developed specifically by KGS Group for this report. Use of rating scales allowed consistency to be established across the various FPS condition assessments. Scaled ratings also allow for rapid comparison of the condition of items within an FPS as well as across all FPS that have been evaluated. These scales also assign precise text descriptors to each condition rating so that the current assessment is easier to understand, and future assessments can easily adopt the same rating scales.

For condition ratings of the FPS dealt with in this report, refer to Table 3.2 – Condition Assessment Summary – Mechanical.

FPS Types

The mechanical equipment present at a given FPS is dependent on the type of station being considered. The FPS assessed in this report can be categorized as four basic types of stations:

1. Centrifugal Pump Flood Pumping Stations (FPS) – 28 out of the 29 FPS covered in the scope of this report are of this type. These stations have from 1 to 5 separately coupled, overhung impeller centrifugal pumps installed in a below-grade drywell. Each pump is driven through a vertical line shaft by an electric motor installed in the FPS superstructure. The pumps draw effluent from the FPS wetwell through the pump suction lines and transfer it through the discharge pipe into the discharge box. This effluent then flows through the FPS outfall and into the river. Wetwell dewatering pumps may or may not be present at any given station to dewater the wetwell for maintenance purposes.

   Other mechanical components present at this type of station are:

   - Drywell Ventilation Fans - Supply fans are installed to provide fresh outdoor air to the drywell. These fans are ducted and are used primarily to provide ventilation for personal protection when operators must enter the drywell. They are also used periodically as a basic method of drywell humidity control.

   - Main Floor Cooling Fans - Cooling fans are installed at some stations. Heat generated on the main floor by flood pump motors and switchgear will tend to accumulate within an FPS if it is not properly ventilated. When warmer spring and outdoor temperatures coincide with operation of flood pumps, indoor FPS temperatures can rise to the point where electrical thermal overloads are activated, thereby causing a loss of flood pumping capacity. To avoid this scenario, some stations are equipped with permanent cooling fans while the rest of the stations are currently provided with temporary fans that are brought in and operated on an "as-needed" basis.

   - Shaft Seal Water Lines – The overhung impeller centrifugal pumps used at these FPS stations are provided with a packing gland. This packing gland prevents the liquid being pumped from escaping past the line shaft and entering the drywell. The packing seal is either a graphite or teflon impregnated braided "rope". This packing requires continuous cooling and lubrication that is accomplished by application of an external clean water source. The shaft seal water source also serves to prevent contaminants and gritty materials from entering the packing rope itself and causing it to wear prematurely. The shaft seal water line is connected to the City water supply and typically enters the drywell near its ceiling level. The line includes a series of isolation, check, gate, pressure regulating and solenoid valves as well as strainers and branch lines that transfer seal water to each pump's shaft seal water line inlet.

- Sump Pumps – These are typical residential style sump pumps installed in an approximately 2' x 2' x 2' sump located at the perimeter low point of the drywell floor. These pumps are activated by a sump float switch and are arranged to discharge through a pipe back into the FPS wetwell. Sump pumps are installed at each FPS and are regularly tested by Water and Waste Personnel. These pumps are essentially a commodity item and are typically replaced rather than repaired when they malfunction.

2. Submersible Pump Flood Pumping Stations (FPS) – Hawthorne is currently the only FPS with this configuration (was built in 2006). This station has two submersible propeller pumps located at the bottom of two vertical discharge columns in the FPS wetwell. The pumps draw effluent from the FPS wetwell and push it up the vertical shafts into the station discharge box. The effluent then flows into the station gate chamber, where it enters the FPS outfall and into the river. Hawthorne does not have a permanent dewatering pump. In the instance of maintenance being performed in the wetwell a portable submersible pump will be used to empty it.

Other mechanical components present at this FPS are:

- A 400 cfm fan is located in the electrical room to vent the room and keep the electrical equipment cool.

3.3.2 Ventilation

Drywell Ventilation

All standard FPS are provided with drywell ventilation systems. Gate chambers and wetwells do not have ventilation fans and do not require them because gate chamber access is so infrequently required that an air test confirming acceptable air quality before and during presence in the gate chamber and wetwells is all that is required for personnel access.

The FPS that are equipped with drywell ventilation systems, typically have a single speed fan located on the main floor (see Photo 3.7). This fan draws fresh outdoor air through an intake louver mounted on the outside wall of the station and transfers it through ductwork into the drywell at approximately 2 to 4 ft above floor level. Some variation is present in these systems - at combined FPS the same fan is sometimes used to ventilate both the FPS and the sanitary station drywells, with the flow to either location balanced by positioning of a damper. The drywell ventilation systems are provided primarily for protection of occupants from contaminated air but they are also used during warmer months as a basic means of humidity control.

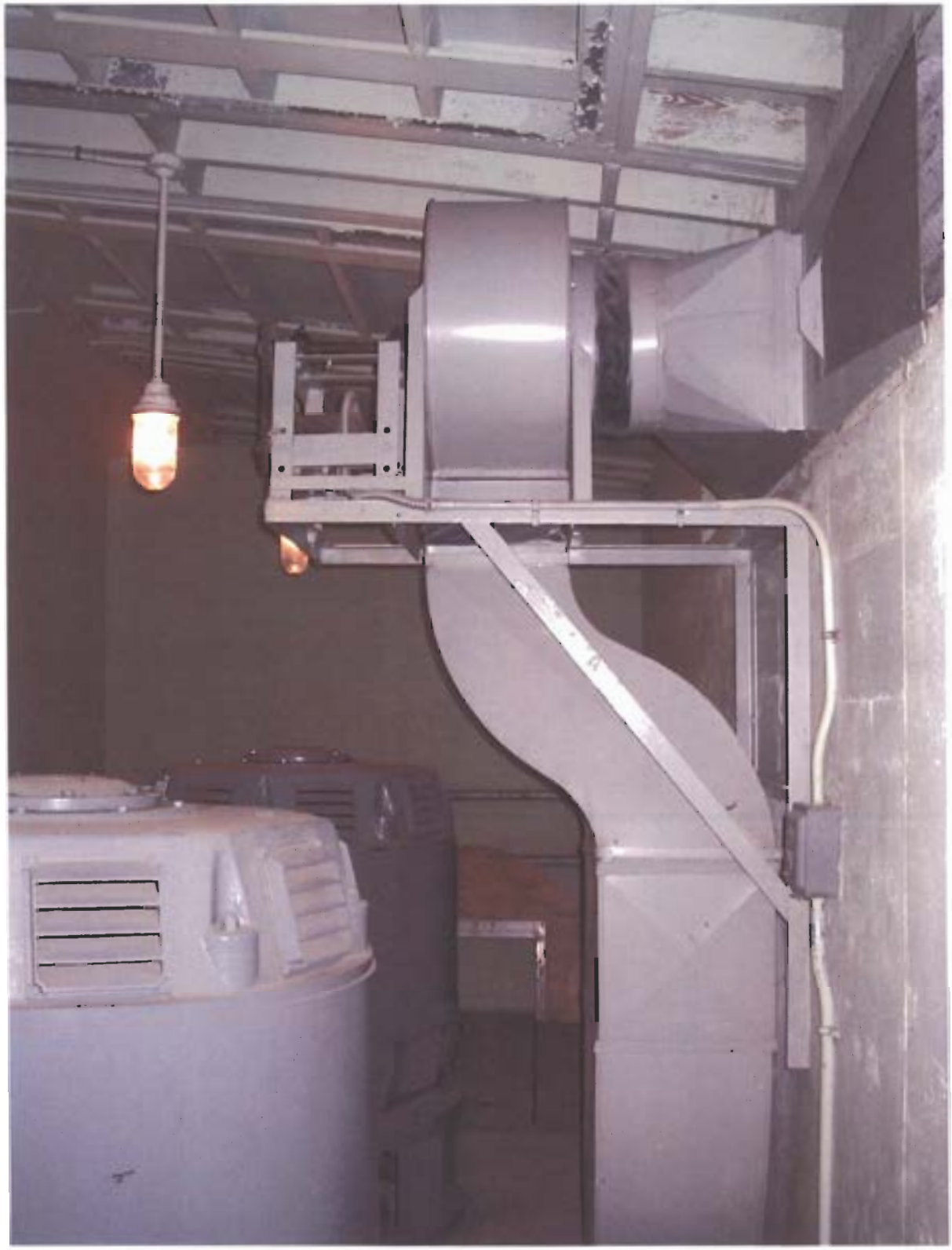


Photo 3.7 Existing Clifton FPS Drywell Ventilation Fan

None of the drywell ventilation fan nameplates or archival drawings (with the exception of Mayfair) contained data on the volume flowrates that can be expected from the installed fans. To approximate these fan discharge capacities, the fan size and horsepower were compared against the same type and size of similar fans with known fan curves and airflow capacities. This estimate of fan airflow capacity coupled with the volume of the drywell as measured during the site visit allowed us to approximate the air changes per hour being provided by a given fan at a given FPS.

The City of Winnipeg Water and Waste Department has established the requirement to provide ventilation for personal protection at a rate of 15 air changes per hour (15 ACH) to a FPS drywell. There are two problems with the current drywell ventilation systems that must be dealt with if the 15 ACH criteria is to be achieved:

1. Since there is only a single fan pressurizing the drywell, there is no direct extraction of contaminated air from the drywell. The supply fan will only tend to dilute the air in the drywell, not provide direct air changes.

2. The supply fans appear to have been arbitrarily installed without performance of fan sizing calculations. One quarter to 1.5 HP fans have been provided, with larger fans assigned to FPS's with larger drywell volumes. Analysis indicates that all of these fans (except Mayfair and Ravelston) are either undersized or in a few instances oversized (Dumoulin, Laverendrye) to meet the 15 ACH criteria.

These problems can be corrected by installation of a properly sized two-fan system that will both supply and exhaust air to the drywell.

Main Floor Cooling Ventilation

Some FPS are provided with permanent main floor cooling fans. These stations are:

- Bannatyne
- Jefferson
- Linden
- Mayfair
- Newton

A photo of a typical existing cooling fan installation is shown in Photo 3.8.



Photo 3.8 Existing Newton FPS Main Floor Cooling Fan

The remaining standard FPS are either provided with a temporary fan that was present when these stations were visited for data collection, or a temporary fan is brought to the FPS on an "as-needed" basis. Temporary Stations do not require a main floor cooling fan.

Installation of a properly sized fan and intake louvers increases FPS reliability by minimizing the potential that the indoor air temperature could exceed electrical thermal overload limits. Further discussion on improving Flood Pump Station reliability and the benefits of FPS cooling are contained in the Flood Control Adequacy Review Study – Final Report authored by KGS Group. The stations provided with permanent main floor cooling fans include a fan that draws air out of the FPS and discharges it outside. The fans are operated by thermostat so that when a setpoint high temperature is reached, the single-speed fan operates at full capacity. Fans are currently not provided with silencers. Air is drawn in through the station's door, wall and roof mounted openings. Louvers are generally installed for air intake, however, air will tend to be drawn in through any openings in the building envelope especially if louvers are undersized.

None of the main floor cooling fan nameplates or archival drawings (with the exception of Mayfair) contained data on the volume flowrates that can be expected from the installed fans. To approximate fan discharge capacity, the fan size and horsepower were compared to the same type and size of similar fans with known fan curves and airflow capacities.

The amount of airflow required for a given cooling fan was compared to the actual installed airflow to determine if the existing fan was undersized. The required airflow was calculated for each FPS based on the following criteria:

- Outdoor temperature is 90°F while FPS indoor temperature is 100°F – this establishes a 10°F delta T.
- Motor efficiencies range from 87.5% for a 20 HP motor to 92.7% for a 450 HP motor. These efficiencies are based on manufacturers' data for motors of the same size and vintage as what is currently installed.
- Switchgear cooling has been considered by adding 10% to the airflow required for motor cooling
- All flood pumps are considered to be running (this does not include dewatering or and/or sump pumps)

- It is assumed that airflow is effectively drawn across the station and that the air does not "short-circuit" from an intake directly to the fan suction.

There are three general problems with the current main floor cooling systems that must be dealt with if the above criteria is to be satisfied:

1. Only five FPS (Bannatyne, Jefferson, Linden, Mayfair, Newton) are currently provided with permanent cooling fans, all other stations rely on temporary systems. Temporary systems are undersized for the application and require intake air to be drawn in through an open door or other provisional means. This requires an additional level of operator attention to initiate and maintain FPS cooling when compared to a permanent system.

2. Based on the criteria, the existing permanent fans are oversized at Bannatyne, Linden, and Newton. Oversizing does not create an FPS reliability problem, but it does raise the noise level generated by the system and is inefficient from an energy consumption standpoint. The permanent fan at Jefferson is marginally undersized. Undersizing a fan does create an FPS reliability issue because the end result is increased potential for the flood pumps to be out of operation during peak temperature operation. It should be noted that Mayfair's fan size is acceptable.

3. The existing permanent fan systems are noisy, a situation that leads to complaints from the occupants of neighboring residences. Noise is minimized by running fan systems only when necessary and configuring the air discharge so that it is directed towards uninhabited areas such as the river.

The problems described above can be corrected by providing permanent cooling fan systems. Such systems would have to be properly sized and designed to provide sufficient cooling while minimizing the amount of noise that would be experienced at neighboring residences when the fans are in operation.

3.3.3 Piping

Shaft Seal Water Piping and Valves

Shaft seal water lines are required at Permanent Flood Pumping Stations only. The Temporary FPS do not use pumps that include a packing gland and therefore shaft seal lines are not necessary at those stations.

At permanent flood pumping stations, the shaft seal line penetrates the drywell as a section of copper pipe at an elevation below the frost line. There is then an isolation gate valve installed

immediately after the entry point. The piping travels vertically down either to a level accessible by an elevated platform or it is routed to 3 to 4 ft above floor level. The main line valve cluster (see Photo 3.9) is installed at this point. This cluster includes a strainer, isolation valves, check valve, tees for floor washdown lines, a tap-in for a pressure sensor, solenoid valve and a pressure regulating valve. The main line is then routed so that it branches off to each flood pump packing shaft seal water inlet. Just prior to this inlet there is a swing check valve and isolation valve installed to ensure water from the wetwell cannot backup into the city water supply line.



Photo 3.9 Existing Colony FPS Shaft Seal Water Piping Valve Cluster

Piping

Shaft seal water piping was originally all copper at every Permanent FPS, but efforts have been made over the years to convert as much shaft seal piping as possible over to PVC at many stations. At stations where PVC has been provided, the only remaining copper piping in the station is usually at the drywell entry point and at the final branch tie-in to the pump. These are pipe sections that cannot be converted to PVC due to the upstream and downstream materials that these pipes must tie into.

In order to assess and compare piping, a relative scale was developed and each section of piping was then evaluated during the mechanical inspection site visits. The scale assigns a Corrosion Rating to each section of piping as follows:

Corrosion Assessment Scale

C0 **No Corrosion** – Surface is in "like-new" condition

C1 **Very Minor Surface Corrosion** – Cross-section is barely affected but minor corrosion is visible

C2 **Minor Surface Corrosion** – Cross-section is slightly affected, corrosion is visible.

C3 **Surface Corrosion** – Cross-section is affected, corrosion is clearly visible

C4 **Advanced Surface Corrosion** – Cross-section is decreasing, structural integrity is still acceptable

C5 **Heavy Surface Corrosion** – Due to loss of base material, structural integrity is questionable

C6 **Extreme Surface Corrosion** – Major corrosive loss with rust-through present at a minimum of one location

At the FPS that were assessed, shaft seal copper piping ranged from C0 "like-new" condition to C5 condition where corrosion had advanced to the point where the integrity of the pipe had to be considered questionable. The range of conditions found at a given FPS for all of the branch and main piping are summarized on the Condition Assessment Summary Table 3.2. For additional information on the rating of a particular branch line or main line, refer to the Data Collection Sheets for a given FPS in Appendix B.

The shaft seal PVC piping was found to be in good condition at all locations that were assessed.

Heavily corroded copper piping can be replaced with new copper piping or where possible, PVC piping that cannot corrode at all. Application of corrosion-resistant coatings can also serve to increase the corrosion resistance of a section of copper pipe.

Joints

The type of joint on shaft seal piping depends on the pipe material and vintage. PVC joints are cemented, whereas copper piping can be soldered at fittings or threaded at valve locations. Threaded teflon is also used at all newer copper piping installations for improved seal performance.

To assess and compare joints, a relative scale was developed and each section of a pipe's joints were evaluated during the mechanical inspection site visits. The scale assigns a Joint Condition Rating to each section of a pipe's joints as follows:

Joint Condition Assessment Scale

J0 Joint is "like-new", excellent seal

J1 Joint is good but not optimal

J2 Joint seal (solder/cement/teflon/threads) is slightly worn, corroded or damaged

J3 Joint seal (solder/cement/teflon/threads) is visibly worn, corroded or damaged, but not leaking

J4 Joint condition may be the cause of periodic leakage

J5 Joint has a definite small leak

J6 Joint has a definite large leak

Cement PVC joints were found to be in very good condition at all stations that were assessed.

Joints on shaft seal copper piping ranged from J0 "like-new" condition to J4 condition. When periodic leakage was found, it tended to be at corroded valve connections.

Joints on copper piping (as opposed to PVC) were also rated for corrosion as per the Corrosion Assessment Scale described in the previous section for piping. Joint corrosion ranged from C0 to C5 with the worst corrosion occurring on lines where the piping itself is also heavily corroded.

The range of conditions found at a given FPS for all of the branch and main piping's joints are summarized on the Condition Assessment Summary Table 3.2. For information on the rating of a particular branch line or main line joint, refer to the Data Collection Sheets for a given FPS in Appendix B.

Heavily corroded and/or leaking joints can sometimes be repaired but corrective action is usually taken through replacement of the pipe itself.

Valves

A standard FPS shaft seal line main valve line cluster includes a strainer, isolation valves, check valve, tees for floor washdown lines, a tap-in for a pressure sensor, solenoid valve and a pressure regulating valve. Branch lines to pumps generally include a swing check and an isolating gate valve.

Valves were assessed based on the Corrosion Assessment Scale described in Section 3.3.3 and shown on Table 3.2. The degree of corrosion damage ranged from C0 at some FPS to C5 on others. Stations with advancing surface corrosion on the valving typically also have a similar degree of corrosion as is found on the station's seal water line copper piping. Some stations with higher corrosion ratings also have occurrences of minor leakage at items such as a strainer cap or a gate valve stem that should be corrected. The range of conditions found at a given FPS for all of the branch and main piping's valves is summarized on the Condition Assessment Summary Table (Table 3.2). For information on the rating of a particular branch line or main line valve, refer to the Data Collection Sheets for a given FPS in Appendix B.

Heavily corroded and/or leaking valves can sometimes be repaired but due to the low cost nature of these items, corrective action is usually taken through outright replacement of the valve itself.

Flood Pump Piping

Suction Piping

In permanent Flood Pumping Stations, suction piping transfers water from the wetwell to the pump intake. These pump suction lines are usually cast iron although Jessie Pump 105 has a carbon steel intake pipe. Cast iron pipe equivalent to a Class D was likely used when the FPS were originally built, although archival drawings do not reference a specific pipe class or wall thickness. This class of pipe would have a 20" pipe with 1.03" wall thickness if the pipe is in new condition. Similarly, 24" pipe would have 1.16" thickness and 30" pipe would have 1.37" thickness in new condition. Carbon steel piping by comparison has a much thinner wall thickness, with standard weight 20", 24" and 30" OD pipe all at 0.375" thickness. Fluid from the wetwell travels through a formed concrete flume that terminates just below drywell floor level where the pump suction line is grouted in at 8 to 12" depth (see Figure 3.1). This pump suction line is routed vertically upward, penetrating the drywell floor and tying into the pump suction via a flanged connection usually followed by a victaulic coupling connection. This piping was originally primed and painted with lead-based paint. Subsequent touch-up painting was performed at some stations with the touch-up painting present on pumps and piping up to elevations 8 to 10 ft above the drywell floor but not at higher elevations.

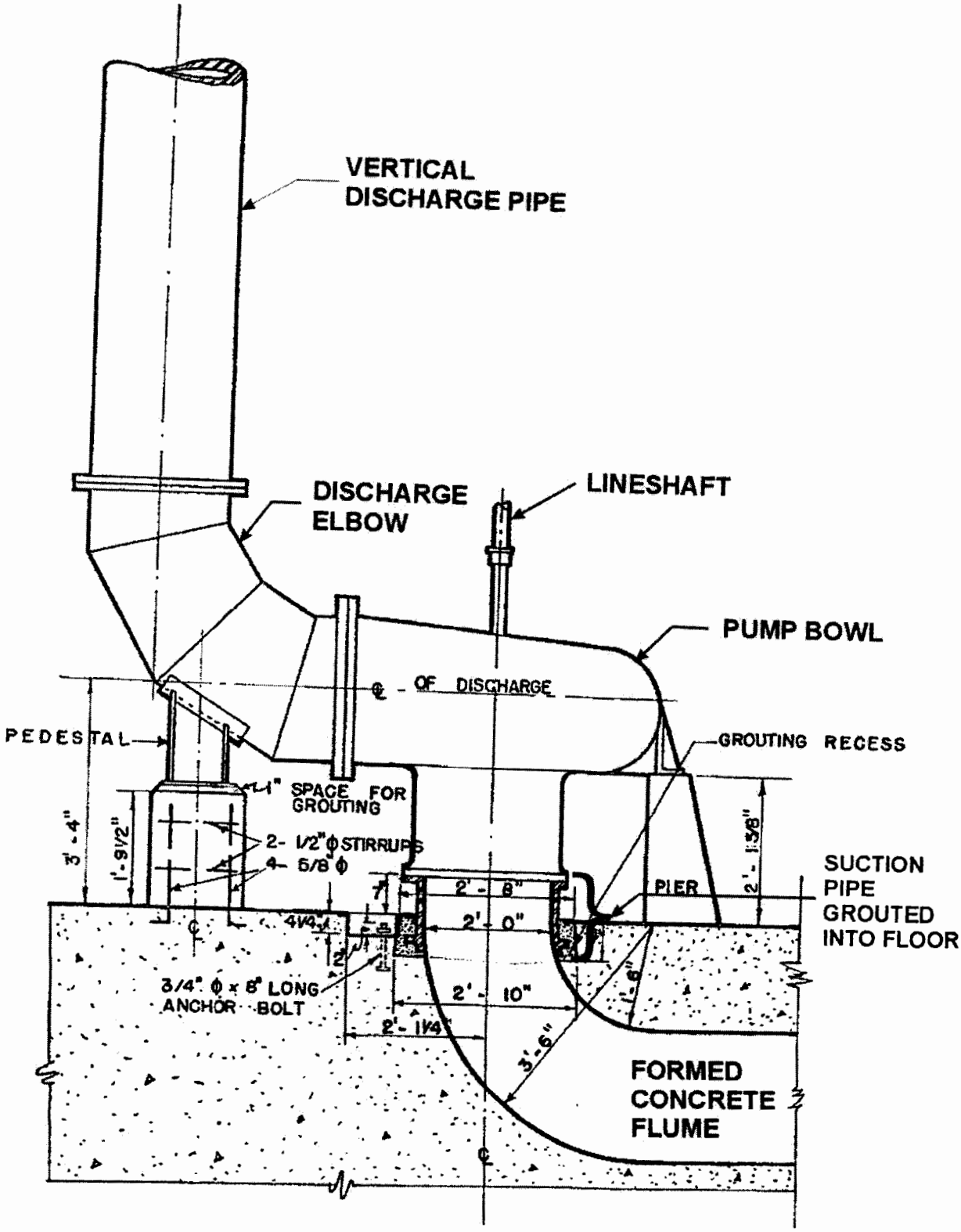


Figure 3.1 Elevation of Overhung Impeller Centrifugal Pump Showing Suction and Discharge Arrangement

External surface corrosion of this piping was evaluated based on the Corrosion Assessment Scale described previously. Surface corrosion tends to be most prevalent at the very base of the suction piping where the pipe meets the floor. Surface corrosion can also be expected at the radial position of the pipe under the pump volute low spot where packing gland water drips down.

At the FPS that were assessed, the external corrosion ratings ranged from C0 "like-new" condition to C4 condition, where corrosion had advanced to the point where the cross section of the pipe was decreasing but the structural integrity of the piping was still acceptable. The range of conditions found at a given FPS for all of the suction piping are summarized on the Condition Assessment Summary Table (Table 3.2). For additional information on the rating of a particular suction line, refer to the Data Collection Sheets for a given FPS in Appendix B.

Surface corrosion was advanced enough at some stations that it was decided to conduct ultrasonic tests at four stations where external surface corrosion was the most advanced. Just as visual inspection had allowed assessment of the extent of external surface corrosion, ultrasonic testing enables limited assessment of the internal condition of the pipe.

Ultrasonic pipe wall thickness testing was performed at Dumoulin, Jessie, Linden and Newton FPS in January 2005. The data collected from this ultrasonic testing is included in Appendix E.

The pump suction and discharge lines were tested to assess the remaining wall thickness at several points selected circumferentially and longitudinally on the lines. The cast iron suction lines thickness measurement typically ranged from 0.9 to 1.1" on a 20" pipe through to 0.8" to 1.2" on a 30" pipe. The presence of Carbon Steel as opposed to cast iron pipe was an anomaly found on Jessie P105 suction. At Jessie P105 the carbon steel suction line wall thickness ranged from 0.327" to 0.360" and at Jessie P107 the cast iron suction line ranged in thickness from 0.375" to 1.048".

The chief limitation of the ultrasonic testing is that all points along the entire surface area of the piping can not be tested. Since only a sampling of points have been arbitrarily selected, it is possible that areas with less wall thickness than the tested area have been overlooked. Testing at an increased number of transducer locations however, would have required a significantly

higher expenditure for stripping of the entire surface of existing lead based paint and subsequent painting of the entire piping surface once the tests were complete. Repainting is necessary to protect the tested areas from rapid corrosion due to exposure of bare metal.

The assessment of the suction line thickness data at these FPS is based on the following information:

1. Material thicknesses at the thinnest measured sections on suction lines tend to be significantly higher than what is present on the discharge lines.

2. Positive internal pressures on these lines are only present momentarily when the pump is shut down as opposed to a sustained, consistent positive pressure as is experienced by the pump's discharge piping.

3. External surface corrosion of piping ranged from C0 to C4 depending on the pump and FPS. This data was visually acquired during the mechanical site inspection.

Based on this information, the material thicknesses on the suction lines are not at a state where replacement would be required. Although external surface corrosion appeared advanced based on visual inspection alone, ultrasonic testing at four FPS indicated that there is usually significant wall thickness remaining due to the high wall thickness that is characteristic of cast iron pipe. Ultrasonic testing on the remaining FPS would allow confirmation of this assessment and is recommended.

The condition of the paint applied to flood pump suction piping was also evaluated at each station. Paint condition is critical because it represents the only barrier between bare metal and the potentially corrosive environment of an FPS. Paint on the suction line was evaluated based on the following scale:

Paint Condition Assessment Scale

P0 Paint is in "like new" condition

P1 Very minor localized discoloration due to corrosion, paint is lightly adhering to surface

P2 Minor discoloration due to corrosion, localized bubbling or flaking of paint

P3 Paint is flaking due to corrosion at several locations

P4 Large sections of painted surfaces are flaking

P5 Most of the surface area of paint has been lost due to corrosion

P6 Paint is completely removed from the surface

The paint condition at the various FPS ranged from P0 "like-new" condition at some stations to P6 at Newton P50 and P52 where sections of paint had been completely removed from the surface due to corrosion. The range of paint conditions found at a given FPS for all of the suction piping is summarized on the Condition Assessment Summary Table 3.2. For information on the rating of the paint on a particular suction line, refer to the Data Collection Sheets for a given FPS in Appendix B.

A corrosion resistant coating would serve to arrest the progression of any further external surface corrosion at stations where coatings are in questionable condition.

Discharge Piping

In Permanent Flood Pumping Stations, discharge piping transfers water from the pump to the FPS discharge box. Pump discharge lines are made of welded carbon steel. The discharge line is coupled to the pump at a flanged connection followed by a victaulic coupling. This piping was originally primed and painted with lead-based paint. Subsequent touch-up painting was performed at some stations with the touch-up painting present on pumps and piping up to elevations 8 to 10 ft above the drywell floor but not at higher elevations. Carbon steel piping has a much thinner wall thickness than cast iron pipe, with standard weight 20", 24" and 30" OD pipe all at 0.375" thickness. There are two different types of discharge line arrangements utilized in the permanent FPS.

The first discharge line arrangement (see Figures 3.2 and 3.3) has the piping run horizontally at pump centerline elevation outward from the pump until it penetrates the drywell wall. The line is grouted in and extends past the wall surface for approximately 12" as a straight section of pipe or a mitered elbow. The carbon steel pipe then terminates at the lower end of a vertical concrete riser. This riser causes fluid to be directed up and into the discharge box.

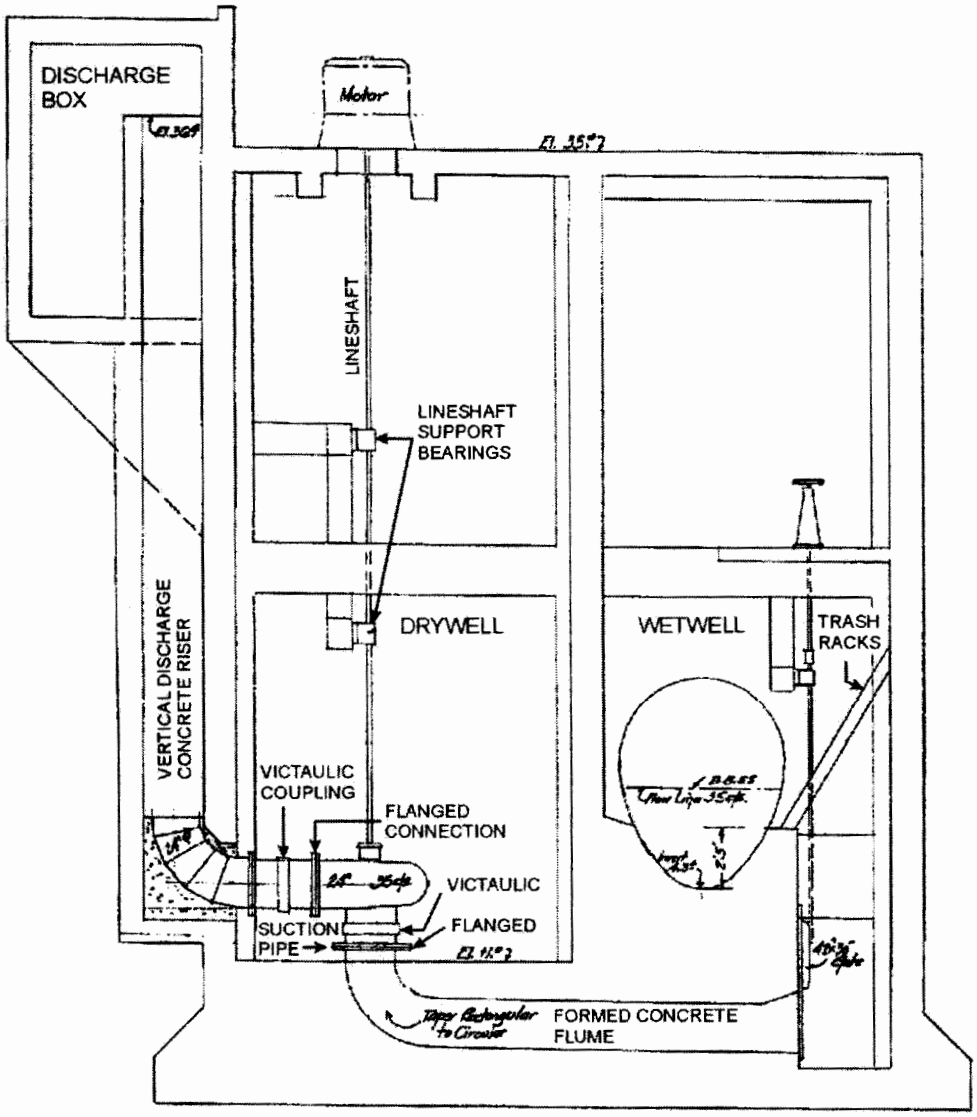


Figure 3.2 Elevation of Below-Grade Components of a Typical Permanent FPS (Vertical Discharge Concrete Riser)

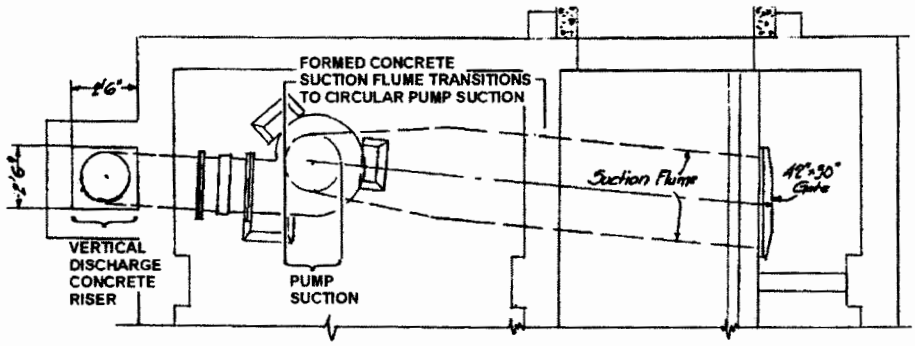


Figure 3.3 Plan View of Typical FPS Pump Showing Intake Channel and Location of Vertical Discharge Concrete Riser

The second discharge arrangement (see Figures 3.4 and 3.5) runs horizontally within the drywell at pump centerline elevation and turns 90 degrees upward before it reaches the drywell wall. Vertical carbon steel piping then transfers the fluid upward until another 90 degree elbow turns the piping to the horizontal just below drywell ceiling elevation. The piping then penetrates the drywell wall and terminates at the discharge box on the other side of the drywell wall.

Temporary FPS do not have permanent pump discharge piping, rather they rely on temporary hoses to transfer water above grade down to the river's edge.

External surface corrosion of the discharge piping was evaluated with the Corrosion Assessment Scale described previously. Surface corrosion was not consistently localized as was the case for suction piping. Rather, when surface corrosion occurs on these lines it tends to be fairly uniform in distribution around the entire surface of the pipe.

At the FPS's that were assessed, the external corrosion ratings ranged from C0 "like-new" condition at some stations to C5 condition where corrosion had advanced to the point where the structural integrity of the pipe wall was questionable and the condition should be confirmed by ultrasonic testing. This C5 condition rating occurred at Newton (P50 and P52), Ravelston (P2 and P3), and St. John's (P27). The range of conditions found at a given FPS for all of the discharge piping is summarized on the Condition Assessment Summary Table 3.2. For information on the rating of a particular discharge line, refer to the Data Collection Sheets for a given FPS in Appendix B.

Surface corrosion was extensive enough at some stations that it was decided to conduct ultrasonic testing at four stations where external surface corrosion was the most advanced. Ultrasonic testing would allow an evaluation of the internal condition of the pipe. Ultrasonic pipe wall thickness testing was performed at Dumoulin, Jessie, Linden and Newton FPS in January 2005.

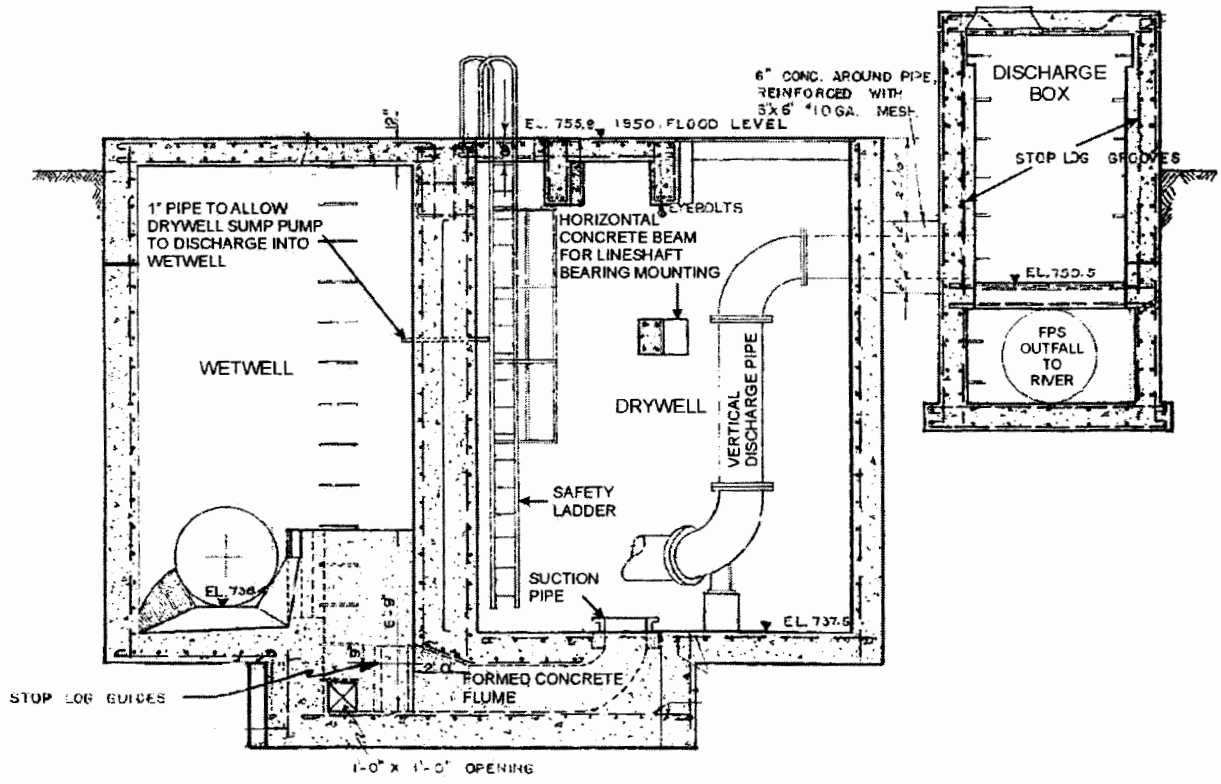


Figure 3.4 Elevation of Below Grade Components of a Typical Permanent FPS (Vertical Discharge Pipe).

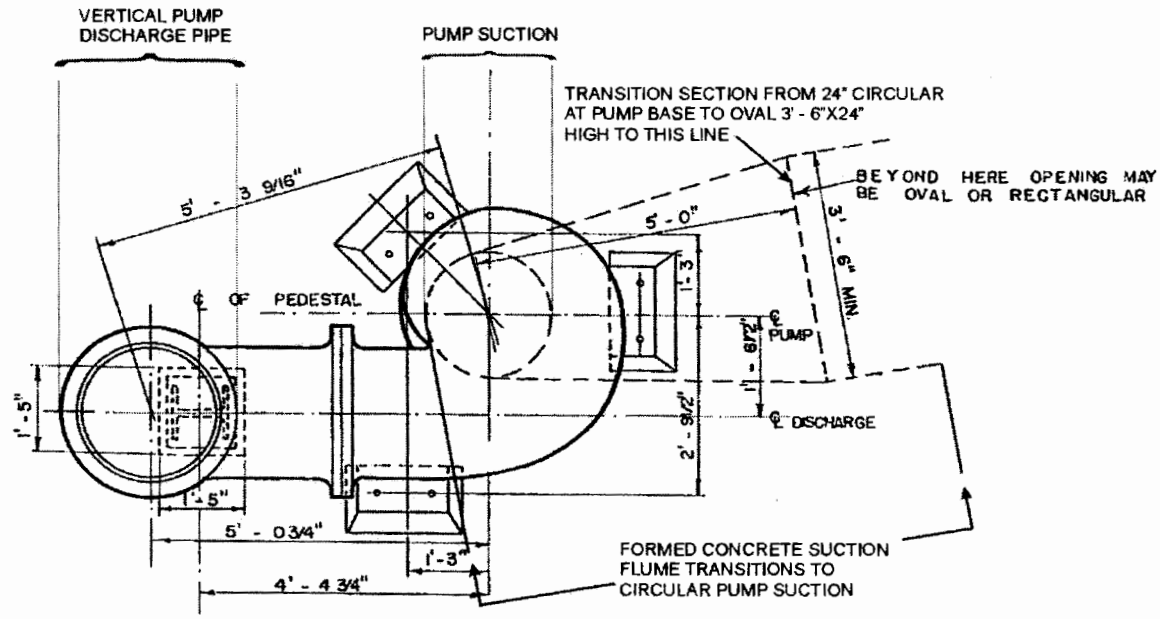


Figure 3.5 Plan view of Typical FPS Pump Showing Intake Channel and Location of Vertical Discharge Pipe.

The pump discharge lines were tested to assess the remaining wall thickness at several points circumferentially and longitudinally on the lines. The welded carbon steel discharge lines wall thicknesses typically ranged from 0.2" to 0.3" on a 20" pipe through to 0.2" to 0.3" on a 30" pipe. Anomalies appeared at Jessie P106 where the 30" line's wall thicknesses ranged from 0.164" to 0.304" and at Jessie P107 where the 30" discharge ranges from 0.170" to 0.307".

ASME B31G-1991 "Manual for Determining the Remaining Strength of Corroded Pipelines" is a supplement to ASME B31.3 and was referred to in our assessment of the condition of the discharge piping at this station. Using this reference, an approximate safe maximum pressure for the corroded area of piping wherever ultrasonic test data was available. This calculated pressure was then compared to the actual working pressure of the system which was estimated at 24 psi or 55 ft. of water. Since the original pipe wall thickness is not indicated on archival drawings, the wall thickness at the thickest section measured ultrasonically was assumed to be representative of a "new / non-corroded" section of pipe. Based on this analysis, it was determined that Jessie P106 and Jessie P107 discharge lines are in relatively poor condition. Although there does not appear to be immediate danger of the pipe failing, the margin of safety is relatively low when compared to other stations that have been tested. Although it is difficult to predict the timing of a failure, for the purposes of this report it is assumed that replacement of the pipe would be required at some point between year 20 and 50.

Although the analysis procedure described in ASME B31G-1991 is the best available, it has the following limitations:

- The procedure applies only to corrosion on weldable pipeline steels (this is an acceptable approach for evaluation of the discharge piping but it cannot be applied to suction piping since those are usually made from cast iron)
- The procedure applies only to defects in the body of the line pipe which have relatively smooth contours and low stress concentration
- The procedure does not determine the remaining strength of corroded girth welds or longitudinal welds or related heat affected zones
- The procedure does not apply to defects caused by mechanical damage such as gouges, grooves, or pipe manufacturing defects
- The procedure does not predict leaks or rupture failures, it only establishes a safe working pressure for the system based on the available data

The chief limitation of the ultrasonic testing that was performed is the number of points along the surface area of the piping that it is practical to test. Since only a small sample of points have been arbitrarily selected, it is possible that areas with less wall thickness than the tested area have been overlooked. Testing at an increased number of transducer locations would require a significantly higher expenditure for stripping of the entire surface of existing lead based paint and subsequent immediate painting of the piping once the tests were complete.

The P106 and P107 discharge lines have wall thicknesses that appear to have experienced an appreciable amount of corrosion and/or erosion damage. This level of corrosion is not apparent from the exterior surface (see Photo 3.10), however some corrosion is masked by the piping's paint and naturally any internal corrosion/erosion is not visible without inspection after disassembling the pipe at the couplings. Although the analysis performed cannot predict the expected timing of a pipe failure, P106 and P107 are in a state where they should be monitored for further damage and an allowance for replacement of these lines should be considered for long-term budgeting purposes.



Photo 3.10 Jessie P106 Discharge Pipe

The condition of the paint coating applied to flood pump discharge piping was also evaluated at each station. Paint on the discharge line was evaluated based on the Paint Condition assessment scale described previously.

Paint condition on the various FPS discharge lines ranged from P0 "like-new" condition at some stations to P6 for Newton flood pumps P50 and P52 where sections of paint had been completely removed from the surface due to corrosion. The range of paint conditions found at a given FPS for all of the discharge piping is summarized on the Condition Assessment Summary Table 3.3. The rating of the paint system on a particular discharge line is given on the Data Collection Sheets for a given FPS Appendix B.

A corrosion resistant coating would serve to arrest the progression of any further external surface corrosion at stations where coatings are in questionable condition.

Joints

Permanent flood pumping station piping is usually equipped with a flanged connection followed by a victaulic connection on the suction side and a flanged connection followed by a victaulic connection on the discharge side. Some FPS do not have the victaulic on the suction side due to slightly different pump configurations but these cases occur infrequently. FPS's that have their discharge pipe routed vertically upward in the drywell do not have victaulic couplings on the discharge side. Ravelston LDPS does not have exposed suction piping, but the discharge piping at this LDPS is connected by flanged, victaulic and dresser connection type couplings. Temporary FPS rely on pumps and discharge hoses brought in as needed and therefore connections are temporary and usually only present at the pump discharge.

The combination of flanged connections with strategically placed victaulic couplings is optimal for flood pumping stations because it makes assembly and disassembly of the system convenient while allowing for minor inaccuracies in the lengths of spool pieces. Note that victaulic connections are not required at an FPS that has its vertical piping exposed in the drywell because a mitered 90 degree elbow that is flanged on both ends can be removed for ease of maintenance, making a victaulic coupling unnecessary.

External surface corrosion of joints was evaluated based on the Corrosion Assessment Scale described previously. Flanged connection surface corrosion tends to be most prevalent at the nuts and bolts, the actual flanges are of substantial thickness and their integrity was always found to be acceptable. Victaulic coupling corrosion tends to be most prevalent at the mounting nut and bolt, although corrosion of the coupling material itself was advancing in some instances.

At the FPS's that were assessed, the flanged connection corrosion ratings ranged from C0 "like-new" condition to C5 condition where corrosion had advanced to the point where the joint could be the source of sporadic minor leakage. Victaulic coupling conditions ranged from C0 to C5 as well, with the worst condition C5 ratings characteristic of couplings that could also be the source of occasional minor leakage. The range of conditions found at a given FPS for all joints is summarized on the Condition Assessment Summary Table 3.2. For information on the rating of a particular joint, refer to the Data Collection Sheets for a given FPS in Appendix B.

Corroding flanged connections, victaulic couplings and/or victaulic mounting nuts and bolts should be replaced before they can deteriorate to the state where the joint integrity becomes questionable.

3.3.4 Pumps

Flood pump types are described in Section 3.3.1.2. Permanent flood pumps are typically complete with three mounting pedestals that are anchored to concrete pedestals to bring the pump centerline elevation in at roughly 3 to 4 ft above the drywell floor.

The pump internals were not exposed during the mechanical site inspections, therefore this assessment is limited to information acquired by external visual inspection at all FPS and vibration testing at selected FPS.

Pump Bowl & Bearing Covers

External visual inspection of all pump bowls (see Photo 3.5 for a typical pump bowl) or volutes indicated they appear to be in good condition. Paint on pump volutes was also evaluated based on the Paint Condition Assessment Scale described previously. In most cases, paint on the bowls themselves was in good condition, with the exception of the top of the bowl on and around the bearing cover (see Photo 3.11 for a typical bearing cover). This area tends to be dirty and often corroded since this is where shaft seal line water and packing rope residue tends to accumulate. Paint Condition varied from P0 "like-new" condition at some stations to P4 condition at Ash FPS. At Ash, all four pumps are corroded around the top of the pump, causing most of the painted surface in those areas to be lost.

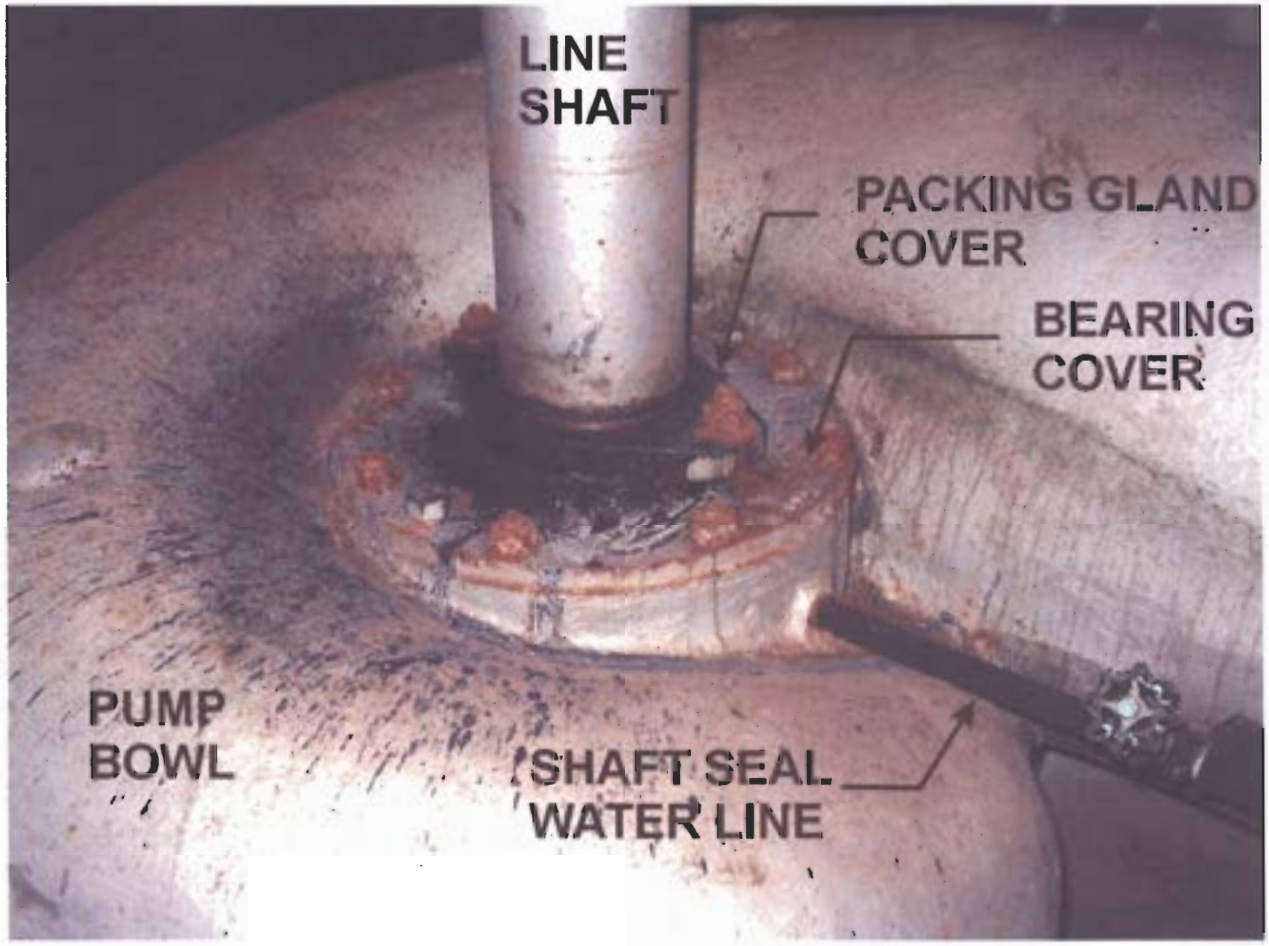


Photo 3.11 Linden P46 – Typical Flood Pump Upper Section

Detailed internal inspection of each pump should be performed when the pump is disassembled for maintenance purposes. This would allow the inspector to confirm the presence of suspected problems as well as detect ones not apparent by previous external inspection. In lieu of performing internal inspection, vibration analysis and ultrasonic testing allow the inspector some knowledge of the internal condition of a system without having to disassemble components. Internal inspection was not included in the scope of this Condition Assessment due to the cost involved and the potential for introducing alignment problems when the system is reassembled after inspection.

The range of paint conditions found at a given FPS for the pump bowls and bearing covers is summarized on the Condition Assessment Summary Table 3.2. For information on the rating of the paint on a particular pump, refer to the Data Collection Sheets for a given FPS. The bearing cover is usually the cause of a poor Paint Condition Rating rather than the pump bowl.

Packing Gland Covers

External visual inspection of all packing gland covers (see Photo 3.11 for a typical packing gland cover) indicated that most are in good condition. Conditions ranged from C0 to C5, with the worst condition packing gland covers found at Ash (P3 and P4).

The range of conditions found at a given FPS regarding packing gland corrosion is summarized in the Condition Assessment Summary Table 3.2. For information on the rating of the cover on a particular pump, refer to the Data Collection Sheets for a given FPS Appendix B. Packing gland covers that are in poor condition due to corrosion should be considered for replacement.

Mounting Hardware

Packing gland covers are present on all Standard FPS pumps while bearing covers and pump shrouds are only present on some pumps. Where corrosion is present, the mounting studs, nuts and bolts on these covers are usually in far worse condition than the covers themselves. Packing gland hardware ranged in condition from C0 to C5 with the worst cases present on Ash P3 and Newton (P50 and P52). The bearing cover hardware ranges in condition from C0 to C5 with the worst condition ratings found at Ash P2, Despins P35 and Metcalfe (P1 and P2). Pump shrouds are somewhat uncommon, and where they are present the mounting hardware is generally removed from the splash area created by the packing gland water supply. Shroud cover hardware ranges from C0 to C4 with the worst conditions present at Cockburn P111. At locations where nuts and studs are at C5 condition, this hardware has corroded to the point where replacement is the only option once the bolts must be tightened or loosened for maintenance purposes.

Pump Bushing Clearances

Vibration analysis is a coarse screening method that detects the presence of machinery faults. The exact location and extent of faults such as bushing clearance problems can only be determined by equipment disassembly and inspection by a qualified technician. The vibration analysis performed at 17 out of 28 stations in 2005 yielded data that indicates pump bushing clearances on several pumps must be assessed and corrected. The pumps requiring further

attention are Jefferson P53, P54, P56 and P57, St. Johns P26 & P27, Metcalfe P29 & P30 and Bannatyne P8. Further details on the vibration testing results and recommendations are given in Appendix C – Pump Shaft Vibration Testing Report.

3.3.5 Lineshafts

Pumps at Permanent Flood Pumping Stations are located in the drywell while the electric motor is located above the pump on the FPS superstructure main floor. Torque is transmitted from driver to pump by a vertical lineshaft. Lineshafts are occasionally stabilized with intermediate bearings mounted on horizontal structural columns in the drywell. These lineshafts are usually coupled with flanged connections although universal joints are sometimes utilized instead.

The vibration analysis performed at 17 out of 28 stations in 2004/05 yielded data that indicates several lineshaft systems have problems that must be must be assessed and corrected. The following summarizes the problems that were detected:

Bearings and Universal Joints – Vibrational analysis indicated these components have extensive wearing at Cornish P103.

Shafts - Vibrational analysis indicated that shafts are bent at Jefferson P56 & P57, St. Johns P24 and Baltimore P26.

Shaft Bearing Clearance – Vibrational analysis indicated that the shaft bearing is not clearing the coupling on Laverendrye P1.

Shaft Condition – Vibrational analysis indicated that the line shaft is in strain at Hart P1.

Shaft Alignment – Vibrational analysis indicated that the line shaft is out of alignment at Syndicate P10

Further details on the vibration testing results and recommendations that are provided in Appendix C – Pump Shaft Vibration Testing Report.

3.4 GEOTECHNICAL

3.4.1 General

The purpose of the geotechnical portion of the assessment was to conduct an overview evaluation of the potential for riverbank instability, which could impact the reliability of the flood pumping stations. Existing riverbank stability and erosion conditions at each site were reviewed based on a visual site inspection, review of stereo aerial photography, review of existing geotechnical reports, and our previous geotechnical engineering experience from having completed numerous riverbank stability assessments and stabilization projects on Winnipeg's riverbanks.

3.4.2 Methodology

Each site was assessed against a number of factors which impact bank stability including:

1. Location of station relative to river meander pattern (inside bend, outside bend, straight section)
2. History of bank stability
3. Erosion conditions
4. Existing bank works (riprap erosion protection, shear keys, toe berms, etc.)
5. Overall bank slope
6. Surface drainage

Riverbank instability is seldom confined to the narrow right-of-way at each FPS. For this reason, the impact of each bank stability variable was assessed at the FPS plus the banks immediately upstream and downstream of the site.

Visual Site Inspection

Visual site inspections were performed between August and November 2004. The bank was examined for evidence head scarps, slump blocks and open tension cracks, which are indicative of historic or active bank instability. Shoreline erosion conditions were assessed relative to potential toe scour and undercutting of the bank. The extent and effectiveness of any existing bank works was reviewed including the condition of construction materials (e.g. potential

degradation of exiting limestone riprap due to freeze-thaw). Surface drainage conditions were examined relative to potential water ponding on the bank and infiltration into the subsurface soils.

Internal Inspection of Outfall Pipes

At select stations a visual internal walkthrough inspection was performed in the station outfall and/or discharge piping. The internal pipe inspections were performed to examine indicators of bank instability such as pipe distress including: joint separations, displacements, vertical breaks or rotation of invert profile, and distortion or flattening of the pipe cross section. The inspections did not include an assessment of the structural condition of the pipe.

Stereo Aerial Photography

A review of available stereo aerial photography taken in 1988, 1992, and 1998 obtained from the Manitoba Conservation mapping branch was performed for each site. The photo series reviewed include AS88012, AS88013, AS92072, and FF98096 and were taken with the river drawn down to its natural elevation and little or no foliage on the trees. In general, the photos offered an unobstructed view of the upper bank and shoreline conditions at the stations, which allowed for comparison of stability and erosion conditions over a 10 year period.

City of Winnipeg Waterway Authority and WWD Library Reports

The City of Winnipeg Waterway Authority maintains an extensive database of all permit approvals and records for construction since approximately 1951 for work within 350 ft of the Red and Assiniboine Rivers. A review of available records for each site was performed to provide an indication of the frequency and type of construction activities along the banks in the vicinity of each FPS. This information provides a good indication of historical bank instability. In general, areas with highly unstable banks usually had several records or permit applications for previous bank repairs. For sections of bank that have been historically stable, the waterways permits did not include the same frequency or extent of bank repairs.

Water and Waste Department also maintains an extensive library of previous studies and reports prepared for the Department. A review of any available reports relative to geotechnical and/or riverbank stability at each FPS was performed to provide details of historic bank performance and previous bank repairs. Reports reviewed as a part of this assessment are given in Appendix A (References).

Field Drilling and Instrumentation

At five FPS sites which were categorized as high risk for riverbank instability (Colony, Despins, Hawthorne, Marion, St. John's), a detailed test hole drilling and geotechnical monitoring program was performed. At each site, two slope inclinometers and three piezometers were installed with monitoring of the instrumentation performed 6 times during this study.

In 2006 the Hawthorne FPS and riverbank was reconstructed. The riverbank was stabilized with rockfill riprap and rockfill columns to provide a shear key. During construction of the riverbank at Hawthorne the lower bank inclinometer was removed and the mid bank slope inclinometer was left in place.

The fall of 2006 slope inclinometer readings at Despin indicated that since September of 2005 cumulative down slope movements of 50 mm and 25 mm of lateral movements have occurred. The magnitude of displacement that has been measured in the past year (since September 2005) is significant in comparison to the displacements measured in previous monitoring periods.

3.4.3 Geotechnical Rating

Riverbank stability was characterized at each site under adverse conditions (saturated bank) as being one of:

1. High Risk of Failure
2. Low Risk of Failure
3. Minimal Risk of Failure

The risk of failure criteria was based on the following:

High Risk of Bank Failure

Many natural or unprotected riverbanks in Winnipeg are considered to have a high risk of failure immediately following draw down of the river after sustained flood conditions. The category of "high risk of failure" was assigned when, in KGS Group's judgement, the riverbank exhibits visual evidence of active historic instability at the FPS site or when a detailed site investigation and computer-aided stability analysis would likely have concluded that, under extreme groundwater and river conditions the bank would have a factor of safety (FS) against sliding of unity or less. Extreme bank stability conditions are defined as saturated or near saturated banks, plus river draw down from high flood levels to normal flow. When such conditions occur on a bank, which has also been undergoing progressive bank erosion and undercutting, bank failure generally occurs either during or immediately following the flood event. Washout of backfill (piping) around inadequately maintained outfall pipe joints further contributes to the potential for riverbank saturation and potential instability.

The following conditions resulted in a site being characterized as having a high risk of failure:

- Any station located on a section of bank showing active ongoing or historic signs of instability unless significant erosion protection (riprap) and bank stability remedial repairs (regrading, crack sealing, shear keys) had been completed a minimum 25 m upstream and downstream of the station.
- Any FPS located on an unprotected bank along an outside bend in the river.
- Any steep near vertical exposed banks (lacustrine or alluvial soils), if erosion protection does not extend a minimum 25 m either side of the outfall.
- An FPS where the condition of the outfall pipe showed evidence of ongoing bank movements such as separated or displaced pipe joints or where backfill washout was occurring around the joints.

Low Risk of Failure

The category of "low risk of failure" was assigned when, in KGS Group's opinion, detailed site investigation and computer-aided stability analysis would have concluded that the bank stability approaches a FS of unity or just greater than unity under extreme conditions. The following conditions resulted in a site being characterized as such:

- Any bank of high plasticity lacustrine clay where riprap erosion protection was in place and the bank slope was generally 5H:1V or flatter for a minimum of 25 m in either direction from the FPS. Based upon numerous computer aided stability analyses on such banks, the riprap blanket, properly constructed, provides erosion protection, plus a minor improvement (typically <5%) to overall bank stability.

- Any station situated on an inside bend with a history of little or no overall bank instability, and with riprap protecting the shoreline.

Minimal Risk of Failure

The category of "minimal risk of failure" was assigned when complete riprap erosion protection extended a minimum 25 m either side of the station, or when extensive bank stability improvement works had been constructed at the site and were judged to provide an adequate factor of safety against sliding under extreme conditions.

Bank stability improvement measures deemed sufficient to warrant an assessment of minimal risk of failure included significant upper bank offloading with grading and surface drainage improvements, construction of extensive riprap erosion protection blankets or toe berms, rock filled shear keys, rock filled caissons, or post-tensioned earth anchors.

3.4.4 Geotechnical Assessment Summary

Of the 29 sites inspected, five were categorized as High Risk, 18 were categorized as Low Risk, and six were assigned a Minimal Risk classification. A summary of the geotechnical assessment ratings and riverbank conditions for each FPS is shown in Table 3.3. A detailed discussion of the individual station assessments, geotechnical inspection forms, and site photographs is given in Appendix B. Hawthorne was originally classified as a high risk site. It was subsequently reconstructed in 2006 and therefore has now been categorized above as low risk.

Minimal and Low Risk Sites

The majority of the stations were classified as minimal or low risk in terms of potential for future riverbank stability. With the exception of Mission all of the other sites in these categories had some form of existing riprap erosion protection in place along the shoreline and no visual evidence of ongoing active bank instability at the sites. In most cases the existing riprap erosion

protection was only in place locally around the outfall pipe outlets, leaving the banks immediately upstream and downstream of the FPS unprotected and susceptible to future erosion, which could lead to potential riverbank instability in the future. At most sites, active ongoing bank erosion was observed beyond the limits of the existing local riprap blankets. An example of such erosion beyond existing riprap is shown on the riverbank photograph below for the Polson FPS (Photo 3.12).



Photo 3.12 On Going Bank Erosion at Polson FPS

At some sites, such as Assiniboine and Galt, there were extensive riprap erosion protection blankets in place that extended a significant distance upstream and downstream of the stations such that future erosion is of little concern. The riprap along the shoreline of the Assiniboine station is shown on Photo 3.13. Other sites such as Dumoulin, Mager Drive, and Metcalfe had extensive riprap blankets in place plus stability improvement works in the form of rockfill shear keys. The stability improvement works at these sites were constructed in past to address previous bank instability issues.



Photo 3.13 Shoreline Riprap at Assiniboine FPS

High Risk Sites

Five sites (Colony, Despins, Marion, Selkirk, and St. John's) were classified as high risk sites. In general, these locations exhibited visual or recorded evidence of either active or historic riverbank instability occurring directly on the FPS Right-of-Way (R.O.W) or along the banks immediately upstream or downstream of the station. Active bank movements are those which are occurring presently as observed from our site walkover inspections and inclinometer monitoring program. Historic bank instability refers to banks that have undergone large shear movements in the past but are currently not moving at a significant magnitude or rate. However, the inactive banks are highly susceptible to future slope movements if the historic slope failures become reactivated. An example of an inactive head scarp along the mid bank area of the Hawthorne site is shown on Photo 3.14.



Photo 3.14 Inactive Head Scarp Mid Bank at Hawthorne FPS (reconstructed 2006)

With the exception of the Marion FPS all of the other high risk sites are located along an outside bend in the river. At all of the sites, there is only a minimal amount of riprap erosion protection along the shoreline and no previous stability improvement works (such as rockfill shear keys) are in place. These sites are susceptible to bank erosion and have a high potential for future instability. In 2006 Hawthorne FPS was upgraded to having a low risk of failure when it was reconstructed using rockfill riprap and rockfill columns to act as a shear key.

3.5 SUBSTRUCTURES AND GATES

3.5.1 General

The condition assessments of the pumping station substructures and gates are based on a visual inspection of each of the stations. The inspections were performed during the winter months to take advantage of lower river levels, which corresponds to low water levels in the gate chambers. A review of the available construction drawings was also performed to further define the repair history of the stations.

Unless noted otherwise, the rating system referenced throughout this assessment utilizes the terms Good, Fair and Poor. In general the word Good means that the item under review is performing well at its intended function and provided it receives reasonable care and maintenance, should continue to function well for at least the next 10 years. Fair generally means that the item is functioning within acceptable limits but the time for repair or replacement is drawing near, possibly within the next 10 years. Poor typically means that the item is ready for major repair or replacement. Intermediate ratings of Good/Fair and Fair/Poor were also used to more accurately define the range of the observed conditions.

An overall summary of the substructure and gate condition assessments is given in Table 3.4 and 3.4A for each of the key components assessed. A description of these components is discussed in the following subsections. A detailed account of each individual station inspection and assessment is included in Appendix B1 to B32.

3.5.2 Substructures

All pumping stations consisted of a formed concrete wetwell, drywell and discharge box with the exception of Hawthorne which does not have a drywell. One wetwell could not be inspected (Bannatyne), because of high water that could not be pumped out.

Main Floor Slab

The main floor slabs are typically located just above the level of the adjacent grade. The slabs are structural, with integrally formed concrete beams, and span across the substructure walls below. In addition to potential live loads due to general use & occupancy the floor slabs support significant concentrated point loads from the electric motors that drive the pumps in the drywell.

The majority of stations had only minor hairline cracks at random locations throughout with a few additional cracks propagating from the bases of the motors. In general these appear to be shrinkage cracks from the original construction and/or freeze/thaw cycling and are not a structural concern. The underside of the slabs were not accessible for inspection due to the presence of rigid insulation adhered to the surface.

Grade Beams

A grade beam runs around the perimeter of each station and supports the superstructure above. The grade beams are typically supported directly by and/or are an extension of the substructure walls below. In some cases the grade beams are taller and form a portion of the superstructure walls.

Eight of the stations have minor cracking on the interior and exterior surfaces of the grade beam. In addition to these eight stations Polson has some medium cracks (1/16" gap) while Colony and Selkirk have some large cracks (1/8" gap and greater). Surface spalling has also occurred at some locations, typically along the cracks. Some of these areas have been patched with grout in the past.

In general, any minor hairline cracks are not a concern but the medium and larger cracks, as well as any spalled areas, should be repaired to prevent moisture infiltration and to maintain structural integrity.

Hatches, Stairs & Ladders

There are many types & sizes of floor hatches at the various stations. Typically each station has a main floor hatch to access the pumps. These are constructed either of precast concrete panels or framed lumber with a plywood surface. In general the concrete panels had minor cracks and were chipped along the edges but were in a Good/Fair condition. Many of the wooden hatches appear worn and are in a Fair condition. Approximately 25% of the station hatches had damaged or missing lifting handles.

As discussed in the Building & Site assessment, the structural adequacy of the wood hatches should be reviewed. The man access hatches, stairs and ladders have also been addressed in the Building & Site assessment and therefore will not be discussed further.

Drywell Walls

Out of the 28 stations with drywells 21 were rectangular and seven were circular. Jefferson is unique in that it is the only station with two drywells (both are circular). The drywells ranged in depth from a minimum of 5.6 m at Syndicate to a maximum of 10.7 m at Jessie.

At least twenty stations have minor horizontal cracks on all walls around the perimeter of the dry well. White residue (efflorescence) and orange staining is evident along cracks indicating past seepage and potential corrosion of wall reinforcement. There is evidence of previous crack injections and/or patching at the majority of these stations. At some stations moisture was actively seeping from the wall cracks. Since the inspections were performed during the winter it is anticipated that the degree of active wall seepage will increase significantly during the springtime thaw.

Surface spalling has also occurred at some locations on the walls at various stations. The Jefferson drywell walls appear to be in the worst condition with significant horizontal and diagonal cracks as well as some severely spalled areas with exposed reinforcing steel.

Since the drywell walls are relatively thick (typically 16") and the cracks relatively small there does not appear to be major structural concerns at this time. However, prolonged seepage can

cause corrosion of the wall reinforcement and deterioration of the concrete itself. Reinforcing steel also expands significantly when it begins to corrode which correspondingly causes spalling of the concrete surface. The combination of these effects could eventually compromise the structural integrity of the wall.

Drywell Floor

The footprint area of the drywells ranged from a minimum of 15 m^2 at Assiniboine to a maximum of 56 m^2 at Colony with an overall average of 38 m^2. The drywell floor slabs are typically composed of mass concrete (up to 5 ft thick) with formed circular inlet passages for the pump intakes.

The drywell floor slabs are typically flat without a positive drainage slope to the sump pits. To facilitate drainage of moisture accumulations on the floor a 2" deep by 3" wide trench has been chipped in the surface of the slab at nine of the pumping stations. In addition to being only marginally effective, the trenches can be a tripping hazard, are aesthetically undesirable and most importantly compromise the concrete cover for the slab reinforcing steel. However, since the slab is so thick, the trenches will have a negligible impact on the strength of the slab.

Drywell Beams

With the exception of Hawthorne (no drywell) and Mayfair (intermediate floor slabs), all substructure drywells have at least one level of intermediate concrete beams spanning between the exterior foundation walls. These beams serve a dual purpose in that they provide lateral support to the pump shafts at approximately mid-height and they also behave as compression struts to resist lateral earth pressures imposed on the foundation walls. A typical drywell beam size is 14" wide by 18" deep. Some of the deeper stations have beams at multiple levels and some of the larger stations have beams in both directions to provide additional support.

Many of the concrete beams have been previously patched at multiple locations along the bottom and sides but these repairs appear to be performing well. A small number of beams at the various stations have spalled areas that are still in need of repair. The shaft guide mounts were generally in a good condition with light surface corrosion on the base plates and anchor

bolts. There were some mounts with heavier surface corrosion but none appear to be at a point where replacement is warranted.

Pump Bases

Many of the reinforced concrete pump bases were in a fair condition. Some of the pump bases have been repaired in the past but many require additional attention. At least 14 stations have pump bases with significant spalling (typically at the corners) and exposed reinforcing steel. There was also some grout shoulder spalling below many of the pump base plates and in some cases significant anchor bolt deterioration. Several bases have separated from the pump base plates completely. This is a concern as the grout is intended to transfer vertical and lateral loads from the pumps into the reinforced concrete bases.

Some of the observed spalling may be due to physical damage (e.g. impact during maintenance operations). However, most of the spalling has likely resulted from moisture that has penetrated through cracks in the aging concrete, causing corrosion and expansion of the reinforcement. As the reinforcing steel expands further cracks are developed, allowing more moisture penetration, until eventually the concrete surface spalls off. Prolonged corrosion of the exposed reinforcing steel will compromise the strength of the concrete base.

Discharge Box

Most stations have a reinforced concrete discharge box immediately adjacent to the drywell. Except for the pump discharge connection into this area, the discharge box is completely separated from the rest of the substructure. It is only accessible from an exterior hatch mounted on the roof or from the outfall pipe when river levels are low enough.

The pumps discharge vertically in a formed concrete passage within the discharge box. The top of this passage can be equipped with removable stoplogs to adjust the discharge level. The stoplogs are set in steel guides that are embedded permanently in the concrete. The discharge water spills over the stoplogs into the main discharge box chamber, which leads to an outfall pipe.

The discharge box concrete at many stations are in a good condition with only minor cracking. However roughly 50% of the stations have more significant cracking and/or spalled areas where the reinforcing steel is exposed and corroded. The spalling tends to be more prominent near the top of the walls and on the underside of the roof slab, particularly near the edges of the roof hatch. For example at the Bannatyne FPS the roof concrete is extremely deteriorated and the supporting angles along the perimeter of the roof hatch opening have lost most of their embedment. Some of the cracks and spalled areas have been patched in the past at various stations.

Although there was not always a direct correlation, many of the discharge boxes that were in a Fair condition had significant moisture accumulations at the top of the exterior wall and on the roof (inside surface). Prolonged exposure to moisture combined with repeated freeze/thaw cycles can result in concrete deterioration. Wall/roof condensation was observed at 14 of the stations that were inspected.

Many of the discharge stoplog guides have only light surface corrosion. However, the discharge stoplog guides at Hart, Polson and Selkirk are heavily corroded with significant section loss. The poor condition of the guides at these stations could restrict the installation or removal of the stoplogs. A few damaged timber stoplogs were also observed.

There is some accumulated debris on the floor of several of the discharge boxes that should be removed. It also appears that unauthorized people are accessing some of the discharge boxes via the outfall pipe. Security screens should be installed.

3.5.3 Gates

General

A reinforced concrete gate chamber is typically located downstream of the flood pumping stations. A flap gate and a slide gate are situated within the chamber. The subsurface chamber is accessible via an access hatch located at grade level. Confined space entry procedures were followed when accessing the gate chambers. This required a retrieval system, gas detector, standby workers etc.

The flap gates prevent backup flow of river water into the sewer system at high river levels and operate automatically based on differential pressure. No lifting devices are required. Flap gates are typically equipped with double action hinges to ensure proper seating of the flap against the frame. However, frequent inspection and cleaning is still required to keep the gates working effectively.

The positive slide gates are located downstream of the flap gates. They are used for emergency control of flow and to facilitate the inspection and servicing of the flap gates. The positive gates are manually raised and lowered, typically by hand-operated cranks or wheels. Bronze seating strips are pressed together by wedging devices when the gate is closed to provide sealing against leakage.

The inspection and evaluation of control gates is somewhat qualitative. There are no established guidelines for analyzing the structural adequacy of existing gates. The main concern is the ability of the gate seating face to seal when in the closed position. Corrosion of the ribs (stiffeners) may not directly compromise the integrity of the gate but it is a good indication that the gate sealing ability may be compromised. Checking the sealing faces with feeler gauges was generally not practical due to cold weather conditions and access restrictions.

Flap Gates

The majority of the flap gates were first installed in the early 1950's when most of the stations were originally constructed. At this time the flap gates were located downstream of the slide gates. In the late 1980's the Water & Waste Department began relocating the flap gates upstream of the slide gates so that they could be accessed during emergency conditions. This program continued into the 1990's and beyond. However, since the original flap gates did not meet Water and Waste Department flap gate standards the majority of the originals were replaced with new gates and thimbles. In some situations the flap gate was installed on the existing slide thimble. The following is a summary of the flap gate condition ratings based on the recent inspections.

Since many of the flap gates are relatively new it is not surprising that 19 of those inspected were still in a Good condition. Only minor corrosion was beginning on the surface of the gate stiffeners and at the edges of the thimble. The gate seating faces were relatively smooth with only minor corrosion.

Two of the flap gates were in a Fair condition (Galt & Mission). The gate & thimble were heavily corroded throughout and have experienced some section loss. There appears to be some lateral play in the hinges. The gate sealing face was still relatively smooth.

One of the flap gates were in a Poor condition (Aubrey). This gate has not been replaced since the original construction. The entire gate has experienced very heavy section loss, including the hinges and bolts. There was also significant lateral play in the hinges. The flap gate thimble was heavily corroded throughout and the anchor bolt heads were almost completely deteriorated. The gate seating face is in a poor condition as it is metal to metal with no sealing strips.

Of the remaining gates, five were rated as Good/Fair and three were Fair/Poor. These three gates were located at Clifton, Hart and Selkirk.

In general the flap gates appear to corrode more quickly than the slide gates and therefore have a shorter life expectancy. Given that they are of similar construction it is likely that the flap gates deteriorate more rapidly because they are subjected to more frequent wet & dry cycles due to their orientation & use (the slide gates are typically in the raised position).

Slide Gates

The majority of the slide gates were first installed in the early 1950's and many are still original. A review of the available drawings indicates that approximately 12 of the slide gates have been replaced since the original construction. Several of the slide gates have also been refurbished and then re-installed at new locations. The following is a summary of the slide gate condition ratings based on the recent inspections.

Nine of the slide gates were observed to be in a Good condition. The slide gates have only minor surface corrosion at the edges of the stiffeners. The thimbles have minor surface corrosion at the edges. The gate sealing face is smooth and without corrosion. The operator shaft and guide mounts are in a good condition.

One slide gate was rated as Good/Fair. Heavy surface corrosion was beginning at some locations on the surface of the frame, gate stiffeners, wedge block & thimble. The gate sealing face is relatively smooth with only minor corrosion. The slide gate was not operated to monitor the travel due to very cold conditions during the inspection. The shaft is in good condition but the guide mount bolts are heavily corroded.

Seven of the slide gates were considered to be in a Fair condition. The slide gate & thimble are heavily corroded throughout but there is no significant section loss. The anchor bolts and wedge bolts have some surface corrosion. One or two anchor bolts on the frame are sheared off. The gate sealing face is relatively smooth with some surface corrosion. The slide gate was operated to monitor the travel and it lowered smoothly. All wedges appeared to come into contact with the wedge blocks. The operator shaft surface is heavily corroded.

Six of the slide gates were rated Fair/Poor. The slide gates are corroded throughout but there is only minor section loss. The anchor bolts and wedge bolts have some surface corrosion. The thimble and frame have heavy surface corrosion. In some cases roughly half of the anchor bolts on the sides of the frame are sheared off. The gate sealing face is rough with surface corrosion. The slide gate was operated to monitor the travel and it lowered slow and rough. The operator shaft surface is heavily corroded.

Eight of the slide gates were determined to be in a Poor condition. The slide gate & thimble are heavily corroded with major section loss. In some cases almost all the anchor bolts on the top and sides of the frame are sheared off. The other anchor bolts are heavily corroded with section loss. In some cases one or two wedge bolts are sheared and/or missing. Some of the wedge surfaces are gouged. The gate sealing face is rough and corroded. The slide gate was operated to monitor the travel during the inspection and the gate lowered slowly and poorly. The operator shaft and guide mounts are heavily corroded with some section loss.

At least nine of the slide gates had anchor bolts that were sheared. This varied from only one bolt to virtually all bolts along the top and sides of the gate frame. It is not obvious what is causing the anchor bolt damage. Some bolts are heavily corroded but retrieved samples of some sheared bolt heads indicate only minimal section loss. In general the bolts appear to be failing at the top of the gate first. One theory is that ice is building up between the upper portion of the gate frame and the chamber wall. The expansion of the ice may be prying the frame and failing the anchor bolts from the top down. This theory and other possibilities must be investigated more thoroughly. In the interim, repair of these anchor bolts should be a very high priority.

Gate Chamber Concrete

Some of the gate chambers have been replaced since the 1950's but the majority of the chambers are original but with some modifications to suit gate relocations. The gate chamber concrete is generally in a good condition at most of the stations although there are some previously patched areas at some locations.

Four of the gate chambers were found to be in a Fair condition. At these locations the concrete between the slide gate and the outfall has spalled areas and multiple cracks. The gate chamber at the Hawthorne FPS was Fair/Poor with some significant spalled areas and large horizontal cracks throughout the bottom half of the chamber. At Aubrey the concrete tunnel between the flap gate and the slide gate is in a Poor condition with multiple previously patched areas.

Some chambers have accumulations of silt and/or debris that should be removed. For example at the Marion FPS the slide gate can not close since there is over 3 ft of silt in the chamber.

Wetwell

Most stations have reinforced concrete wetwells that are adjacent to the drywell. The wetwell is only accessible through a hatch in the floor of the pumping station or a hatch just outside of the pumping station.

The wetwells house the trashracks and slide gates for the intake passages to the station pumps. The water enters through the trashracks into the intakes and is pumped up and into the

concrete discharge boxes. Some of the wetwells have a round configuration with the majority of them being rectangular.

The wetwell reinforced concrete consists of the roof and roof beams, walls, integral columns, and floor, with some having intermediate slabs and beams. The concrete roofs were generally in a good condition with only minor spalling but roughly 55% of them had medium to large localized spalling with exposed rebar. Roughly 60% of the walls and columns have cracking and localized spalling with exposed rebar. The concrete floors and inlet/outlet culvert transitions are generally in a good condition with only minor cracking and spalling. Two wetwells have inlet/outlet culvert transitions that have large spalling with exposed corroded rebar. Roughly 30% of the wetwell floors are entirely covered with silt and debris and need to be cleaned out. Roughly half of the wetwells have intermediate slabs and beams. These are all in a good condition with only minor concrete spalling.

Only 25% of the wetwells have slide gates for the pump intakes. The slide gates were originally installed to facilitate dewatering of the intakes for maintenance of the pumps. The slide gates could not be inspected because of high water levels behind the trashracks. The slide gate shafts and hangars were inspected and 40% have heavy corrosion with section loss and damaged shaft guides.

All of the wetwells have permanent access ladders mounted to the concrete walls. A few of the ladders are equipped with cages, but the majority does not. Roughly 55% of the access ladders are in a poor condition with damaged rungs and/or heavy corrosion with section loss. There are some areas where ladders need to be added or extended to improve access and safety. The wetwells that have intermediate slabs have railings at the intermediate level as well. Roughly 35% of these intermediate slabs require additional railings or existing railings replaced to improve safety.

The wetwell trashracks are generally in a good to fair condition, with roughly 80% requiring attention to some degree. Roughly 15% need additional trashracks added or the existing trashracks replaced and 65% need to be cleaned and inspected because the trashracks have significant debris covering them and are plugged up.

3.6 ELECTRICAL

3.6.1 General

The KGS report "Flood Control Adequacy Study" looked at 14 representative stations and examined the following electrical aspects of the flood pumping stations. The study determined that the existing motors, motor starters, main distribution, pump controls, and SCADA system are generally in acceptable condition and typically do not require upgrade. There is, however, some refurbishment required on the ITE breakers.

3.6.2 Main Service

Main service information was gathered for KGS by WWD. A summary of information can be found in Table 3.5, Fault Levels and Interrupting Capacity Data.

The main services (Manitoba Hydro) were found to be of adequate capacity. WWD has an ongoing program of upgrading the main transformers and services where required for public safety or where the equipment does not meet the current Canadian Electrical Code. Other than in those circumstances, the services were judged to be adequate and no remedial work will be required. There are a few exceptions where the interrupting rating of the equipment could not be determined and the available fault current is significant. In these cases an upgrade is recommended.

Further study was also performed to ensure that the original fault current ratings for the main electrical equipment are still valid. The concern was that age has caused these breakers to deteriorate. The study determined that the ITE distribution breakers will need to be refurbished however they do not need to be replaced. This refurbishment is considered a high priority item.

The motor starters for the pumps were found to be in good condition and capable of providing reliable service. Although they are old, they are of heavy-duty construction and have been used very infrequently due to the nature of the FPS. Spare parts are still available. Accordingly, no remedial action is required for the starters.

3.6.3 Flood Pump Motors

The report determined that the flood pump motors were also judged to be in acceptable condition with no major remedial action required. WWD has an ongoing program of upgrading the motor insulation on selected stations. Where moisture is present the existing insulation absorbs the moisture and reduces the motor insulation values. This requires drying out in the spring before use. The motors are removed and refurbished with a better quality insulation system. The costs for this ongoing program are not included in these estimates.

3.6.4 Flood Pump Controls

The report determined the existing bubbler or ultrasonic level control systems were in adequate condition and did not require any major upgrade. The dial up monitoring system was judged to be in good condition. WWD is considering a major upgrade of its' monitoring system and the costs and scope would be handled as a separate project.

3.6.4 Lighting

Generally, for each FPS the lighting on the interior was found to be insufficient for work without supplemental lighting. Exterior lighting was generally absent or minimal. Lighting on the interior should be upgraded to a more modern fluorescent fixture to allow for ease of working without the installation of task lights. Exterior lighting may be updated to modern High Pressure Sodium (HPS) wall type fixtures, this would provide better security lighting for the stations.

RECOMMENDED
UPGRADES

4.0 SUMMARY OF RECOMMENDED UPGRADE MEASURES

4.1 GENERAL

The recommended upgrade measure for each of the work areas are summarized below. These measures are based on the individual station assessments given in Appendix B and from the basis for the cost estimates described in Section 5.0.

4.2 BUILDING AND SITE

4.2.1 General

Estimated costs for all anticipated Building and Site related allowances for items requiring repair, replacement or upgrading at individual stations over the 50 year scope of this study are presented in Section 5.0. The recommendations that form the basis for development of the Building and Site cost estimates are described in Sections 4.2.2 to 4.2.6.

4.2.2 Building Superstructures

Framing Systems

Other than changes due to a Major Aesthetic Upgrade (Bannatyne only) or the addition of a separate entrance at the Combination Stations, it is recommended that the framing remain as is. Localized repairs or replacement of framing assemblies will be done as noted in the individual station reports (Appendix B). This would typically involve preparing the structure as required by bracing and/or shoring, removal of the damaged or deteriorated area or assembly, and the subsequent repair or replacement with new materials. All repairs and/or replacements should be done using similar or superior materials (where appropriate). On exterior repairs, work should be done to provide a well-blended seamless appearance.

Roofing Systems and Trim

In most cases, sloped roofs with asphalt shingles or wood shakes should be reroofed with high quality asphalt shingles when required. It is recommended that new asphalt shingles be installed over a 2-ply nonperforated No.15 roofing felt underlayment. These should be installed with prefinished metal drip flashings along all edges, and with ice and water shields at eaves and valleys.

Existing felt & gravel built-up roof membranes should be replaced with a new 2-ply SBS Modified Bitumen membrane system when required. Where appropriate, a thin application of tapered insulation to improve the drainage characteristics of the roof should be provided.

All roofing replacement should include the repair of all damaged and/or deteriorated substrates exposed after the removal of the existing roofing. The existing roof structure and substrates should also be patched and repaired as required. All metal trim with should be replaced with new prefinished metal equivalents. Any wood blocking or sheathing used in the roofing replacement or repair will utilize pressure treated material. Also, all roof hatch covers should be replaced with new units utilizing pressure treated lumber and plywood covered with a new prefinished metal pan flashing over a roofing felt underlayment.

For roof trim repairs or upgrades, all existing wood fascias and soffits panels will be removed. New pressure treated fascia and trim boards should be installed and covered with prefinished metal. As well, new prefinished vented metal soffits panels should be installed along with prefinished metal roof drainage components and trim.

Wall Finishes and Trim

Unless noted in the Aesthetic Upgrade section below, existing wall finish types both interior and exterior should remain. Although prone to moisture staining, the unfinished hardboard paneling on the interior faces of station walls is an acceptable material and can remain.

Painted wood siding not scheduled for an aesthetic upgrade should be repaired where required or totally replaced with new boards. Where only localized replacement of siding boards is done,

the remaining siding and trim should be stripped to bare wood and refinished with a high quality breathable exterior paint system.

Damaged stucco walls should be locally repaired. These walls should be pressure washed carefully to remove loose paint and debris, and repainted with an appropriate high quality breathable exterior paint system.

Damaged or broken bricks should be repointed. Eroded or cracked mortar joints in brick stations should be replaced.

Doors and Windows

Doors and frames should be replaced as required. Replacement units should be 16 gauge steel doors c/w 16 gauge steel frames. To minimize deterioration due to corrosion, doors and frames should be constructed using hot-dipped galvanized steel. To minimize potential freezing, doors and frames should be filled with injected, or spray-on polyurethane foam should be specified.

Since windows are normally a source of considerable condensation and a weakness in station security, they should be removed as described in the individual station reports. The openings should be filled in with construction that matches the existing wall, or where appropriate for appearance, rebuilt as a contrasting panel to mimic the appearance of a window.

4.2.3 Interior Features / Safety Issues

Stairs and Ladders

Unless a station is the subject of a Major Aesthetic Upgrade (Bannatyne only) (see Photo 4.1), it is unlikely that the city will be obligated to upgrade a pre-existing original construction condition to comply with current codes and regulations.



Photo 4.1 Bannatyne FPS – Scheduled for Major Aesthetic Upgrading

The recommended improvements to current drywell safety conditions associated with access stairs and ladders is limited to the addition of an intermediate horizontal guardrail at all intermediate stair landings and platforms where a centre rail is not already provided.

The foamed plastic insulation should be removed or at least cut back at stair handrails and ladders where the minimum required hand or toe clearances are not achieved. The current required clearance between a handrail and the wall should be 50 mm, and the toe clearance should be 175 mm from the center of a rung to the face of the wall. Because this item could easily be done by operations personnel, no allowance was provided for this item. Although no obligation exists to improve the existing conditions, the City of Winnipeg Water and Waste Department may wish to consider this particular issue in more detail since it affects the well-being of their employees.



Photo 4.1 Bannatyne FPS – Scheduled for Major Aesthetic Upgrading

The recommended improvements to current drywell safety conditions associated with access stairs and ladders is limited to the addition of an intermediate horizontal guardrail at all intermediate stair landings and platforms where a centre rail is not already provided.

The foamed plastic insulation should be removed or at least cut back at stair handrails and ladders where the minimum required hand or toe clearances are not achieved. The current required clearance between a handrail and the wall should be 50 mm, and the toe clearance should be 175 mm from the center of a rung to the face of the wall. Because this item could easily be done by operations personnel, no allowance was provided for this item. Although no obligation exists to improve the existing conditions, the City of Winnipeg Water and Waste Department may wish to consider this particular issue in more detail since it affects the well-being of their employees.

Guardrails

In general, permanent fixed guardrails are provided at most stations around the major equipment floor hatches. For those that do not have fixed guardrails, the use of portable units is acceptable provided that the requirements of the Workplace Safety and Health Act of Manitoba are met during access and lifting operations.

Galvanized steel guardrails along sides of existing exterior stairs identified in the study should be installed, and an allowance for this work has been provided in the cost estimate.

Floor Hatches

Existing floor hatches, particularly the wood framed units, should be examined to ensure general condition and structural adequacy of the hatch and bearing points, in accordance with the floor loading requirements of Part 4 of the Manitoba Building Code. This could be done on an individual basis when the hatches are opened during a regular lifting or maintenance operation. Inspection should include the removal of the existing foamed plastic insulation to fully expose the underside of the hatch and all bearing points. As this insulation does not meet the current building code, it should be discarded and replaced with new insulation unless approval is obtained to allow the insulation to remain (see discussion below). No allowance has been provided for this work in the work program at this time.

Foamed Plastic Insulation

Although the insulation presently in-place performs its intended function of eliminating condensation and frost build-up very well, it does create a potential hazard due to its high combustibility and high flame spread rating. Unlike the stairs and ladders this material was added without approval after the stations were originally built and thus, is in violation of the current building code. Unless approval from the local Authority having Jurisdiction is obtained to allow this condition to remain, the City of Winnipeg Water and Waste Department could be held liable if someone was injured as a result. If such an approval cannot be obtained, the insulation should be removed and replaced with a comparable system allowed by the code. Alternatively, the existing insulation could be covered with an appropriate allowable thermal barrier. An

allowance has been included for the installation of a wood based panel plywood thermal barrier. This option was chosen as it would be durable and appropriate for the environmental and physical conditions present in the drywell.

4.2.4 Building Site and Security

Site Paving

With the exception of a small number of stations where a new concrete driveway is recommended to replace an existing gravel drive, the existing driveways were considered to be adequate both in function and condition and do not need replacement. Allowances were included for the future repair of driveways at a number of stations.

Where an enclosed security fence compound is to remain at any given station it is recommended that the area within the compound be paved with concrete or asphalt. This would simplify maintenance and improve the appearance of the station site by preventing the growth of weeds and eliminate the need to cut grass in these compounds. Cast-in place concrete paving would be preferred over interlocking pavers due to maintenance and theft considerations.

Site Drainage

Where site drainage was assessed to be poor and in need of improvement, allowances have been included for this work. Although the individual conditions of each of these stations will require separate assessment, the general approach would be to reduce the height of grade around the station to a level that is below the main floor slab as this will minimize the likelihood of water flow into the station building. To prevent water from collecting around the station it is recommended that where possible a shallow drainage be created swale to divert water away from the station to either the roadway or the river.

Fencing

Ornamental fencing and/or guardrails, where provided, should be maintained along with other building trim. Typically a steel or wood fabrication, regular painting to maintain appearance and prevent deterioration is recommended. If a fence serves a real and desired function it should be maintained, otherwise it should be removed. Security fencing is discussed below.

No allowance for removal or upgrading the security fencing has been provided in the work program.

General Security and Vandalism

The trend to provide better locks as individual stations are upgraded or doors are replaced should be continued. Locksets should be heavy-duty stainless steel commercial grade units with master-keyed security type cylinders. Doorframes should be well blocked, and doors should be provided with purpose-made anti-pry protective plates at lock locations.

Fencing appears to have provided little additional deterrent to unauthorized entry to those intent on mischief or vandalism. Where real or potential hazards are present, sites should be enclosed with fencing to provide protection to the general public and small children. Otherwise, unnecessary fencing only becomes a maintenance issue. Where protection is needed and is to be provided by a fenced enclosure, the interior of the enclosure should be paved as recommended above to eliminate maintenance and appearance problems.

Although no costs have been included for additional lighting in the Building and Site section, it can be a security feature that could conceivably reduce the incidence of vandalism. Rather than recommending additional lighting for all stations, the recommendation is to provide lighting to those stations where it is most required. Such lighting should be designed and installed to provide sufficient lighting around the building perimeter to adequately expose anyone within close proximity to the building, while at the same time limiting the amount of stray lighting that could potentially annoy the neighbours. To be most effective, the lighting should by controlled be either a photo-cell or a motion detector.

4.2.5 Aesthetic Upgrading of Building Exteriors

Aesthetic upgrading referred to in this section refers to an all encompassing change or improvement to the overall exterior of a given station as opposed to the general repair or replacement of a particular building component or system.

The total design, construction and administration cost of the most recent Galt station renovation exceeded $300,000.00 dollars. Because of the high cost, similar Major Aesthetic Upgrades, which would typically include considerable reconfiguration in addition to the total upgrading of the exterior building components, are limited to only one station. The Bannatyne station was already identified by the City of Winnipeg as the next station to receive a major upgrade due to its proximity to Waterfront Drive and the proposed downtown development. It is agreed that this station should be subject to a "Major Aesthetic Upgrade".

Utilizing the criteria discussed in Section 3.2.5, it is recommended that several other stations receive a lesser "Aesthetic Upgrade". Primarily due to their poor conditions and somewhat dated appearances compared to neighbouring homes, the superstructures and exteriors of these stations should be repaired and upgraded.

The stations that are recommended to receive an Aesthetic Upgrade, are listed in the Aesthetic Upgrade Candidates Table 4.1 and include:

- Baltimore
- Hart
- Mager
- Newton
- Polson
- Selkirk
- Syndicate

In some cases, a reconfiguration of the station may be necessary, particularly the Combination Stations such as Newton and Polson, which would likely include an addition to enclose a separate entrance to the sanitary component. Some site work, such as replacing a gravel driveway with a new concrete drive, is recommended at the chosen stations that do not already have one. In general, these stations would have their exterior completely replaced and updated.

The stations that are recommended for an Aesthetic Upgrade are all in residential neighbourhoods. Painted wood siding or stucco is the recommended wall treatment. Sloped roofing should remain as shingles and flat roofing should be changed from felt and gravel built-up roofing to SBS Modified Bitumen. Roof trim would all be replaced with pressure treated wood, and be clad with prefinished metal. Soffits would be vented prefinished metal. Drainage trim where recommended would be prefinished metal.

Syndicate is an exception and should receive a new sloped prefinished metal roof, and its existing brick veneer should be replaced with a new concrete block veneer. This station is a stand alone structure across the street from an older residential neighbourhood and has received significant mechanical damage to its brick façade with the etching of initials. Split face concrete block would provide a more durable and irregular surface that should deter much of this type of damage. A natural multi-tone block should be used, and if graffiti becomes an issue, spot spray painting could be done to blend with the original block colour tones, or ultimately, complete painting of the block could also be an option.

The total cost of this type of upgrade is estimated to be approximately $150,000.00 per station or less and has been included as an allowance in the cost estimate, as outlined in Section 5.0.

4.2.6 Combination Stations and Humidity Control

It is recommended that all Combination Stations (except Mayfair) be provided with a new well sealed corrosion proof door in the passageway between the flood pump station and the sanitary station. If this does not successfully control humidity they should be provided with a new entrance way into the sanitary sewer areas that is fully sealed and separate from the remainder of the flood pump station. Common to both options any openings or hatches in the sanitary floor would be sealed and the ventilation systems separated (see mechanical). This should significantly reduce the amount of additional deterioration caused by the sanitary component of the station.

Except for Cockburn, where a separate entrance could possibly be created within the existing building area by enclosing and reconfiguring the existing access ladder/pit and providing a new exterior doorway, other such entrances would likely involve an addition attached to the existing

station. This addition should be constructed using moisture resistant materials and an effective vapour/air barrier designed to prevent exfiltration of air/moisture from the sewer chambers through the exterior roof and wall assemblies. Despite venting the addition to the exterior (see Mechanical), wall and roof assemblies should be insulated to allow a future or localized heating unit to operate more effectively.

These additions should be designed to blend in with or even improve the aesthetics of the existing station. Where possible, access to the existing subsurface chamber should incorporate a stair instead of a ladder. The existing access (typically from within the drywell) would then become redundant and should be in-filled and sealed to prevent air/moisture transfer from the sanitary sewer areas to the flood pump station.

4.3 MECHANICAL

4.3.1 General

Each Flood Pumping Station will benefit from a selection of mechanical upgrades. The following sections summarize the recommendations that have been made based on review of the Mechanical Condition Assessment.

4.3.2 Ventilation

Drywell Ventilation

Permanent Flood Pumping Stations have drywells that require ventilation for protection of occupants from contaminated air. The existing systems at these stations (with the exception of Mayfair) are either undersized or in a few instances oversized (Dumoulin, Laverendrye) to meet the 15 ACH (Air Changes per Hour) that has been established by the City of Winnipeg Water & Waste Department.

A two-fan system, complete with a new two-speed supply fan and a single speed exhaust fan is proposed to provide a consistent 15 ACH flowrate. With this arrangement, the supply fan is installed to draw air through a main floor exterior louver and duct the air to approximately

2 to 4 ft above drywell floor level. The exhaust fan system draws air through ductwork that begins at the top of the drywell and discharges to outside the FPS. This two-fan system (with the supply fan delivering slightly less airflow than the exhaust fan is extracting) ensures that direct air changes are being provided, rather than allowing the possibility of contaminated air only being diluted.

For combination stations, where the drywell ventilation fan services both the flood pump station and the sanitary pump station, the existing fan should remain at the station to service the SPS, since the new fans will service the FPS drywell only.

Control of the proposed system would have three selectable settings – OCCUPIED, UNOCCUPIED, and OFF. Description of these settings is as follows:

Occupied – Two-speed supply fan on high speed, single-speed exhaust fan on. This setting is intended to provide protection of occupants from contaminated air and would be started once a crew arrives on site with the intent to enter the drywell.

Unoccupied – Two-speed supply fan on low speed, exhaust fan off. This setting is intended to provide a basic level of humidity control when the FPS is unoccupied. This setting would only be used during warmer months, however. Operation of this setting during colder months could cause temperatures in the drywell to drop below 0°C. Providing supplementary heating to bring outdoor air to a temperature greater than 5°C and allow operation of the system during colder months is not recommended due to the associated fuel costs.

Off – Both fans off.

FPS's are recommended to receive systems with fan sizes ranging from 650 cfm (Laverendrye) to a 3 800 cfm system capable of servicing Jefferson Drywells 1 and 2. Existing ductwork, fan support frames, louvers and wall/floor penetrations can be reused. Existing supply fans can be reused in some instances (i.e. Laverendrye can use the existing single speed 700 cfm fan as a supply fan) but in most cases, new fans would have to be purchased.

All stations already have an existing drywell ventilation system and standard confined space entry procedure requires performance of air testing prior to and during drywell entry. Since these safeguards are in place, the Drywell Ventilation upgrade has been assigned a "low" priority with implementation recommended in the 0 to 5 year timeframe. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

Main Floor Cooling Ventilation

Permanent Flood Pumping Stations require cooling fan systems to ensure temperatures on the main floor do not exceed 40°C. Some cooling fan systems are installed, but these systems (with the exception of Mayfair) are usually not properly sized and the noise control strategies implemented at these stations can be improved upon.

The proposed main floor cooling ventilation systems would have a vaneaxial fan installed that draws air through the station. The ideal cooling fan system would include the following features:

- Fan is adequately sized to provide cooling for pump motors and switchgear when all flood pumps are in operation, with a design indoor temperature of 100°F and outdoor temperature 90°F.
- Intake air louvers installed at one side of the FPS and the cooling fan would be installed at the opposite side, allowing cooler outdoor air to be drawn past the flood pump motors.
- Fan is equipped with a variable speed drive and controlled by local thermostat. Fan speed ramps from 40% to 100% depending on indoor temperature. This will allow power consumption and noise generation to be as low as possible when fan operation is required.
- Vaneaxial fan is complete with silencer to minimize noise generation.
- Fan discharge is oriented away from neighboring residences to minimize noise levels to on either side of the FPS.

Systems as described above would involve fan sizes ranging from 2 000 cfm at Laverendrye to 18 000 cfm at Ash. The following stations have existing cooling fans and are recommended to be dealt with as follows:

- **Bannatyne** – Existing fan is oversized at 11 000 cfm since only 9 000 cfm is required, recommend that fan remains at this FPS. Future consideration could be given to adding

a silencer and variable speed drive to this fan but this has not been included in the recommended upgrade cost estimate since desired cooling capacity is already being provided.

- **Jefferson** – Fan is marginally undersized at 14 000 cfm when 16 000 cfm is required. Recommend installation of new system to achieve desired cooling capacity.

- **Linden** – Fan is oversized at 14 000 cfm since only 6 000 cfm is required. Recommend transfer of this fan to Clifton FPS where a 14 000 cfm fan is required. A new 6 000 cfm is then required for Linden.

- **Mayfair** – Fan is marginally oversized but is recommended to remain at this FPS.

- **Newton** - Fan is oversized at 14 000 cfm since only 6 000 cfm is required. Recommend transfer of this fan to Jessie FPS where a 14 000 cfm fan is required. A new 6 000 cfm fan is then required for Newton.

All other FPS's not mentioned above would require a new cooling fan system. The Main Floor Cooling upgrade has been assigned a "low" priority to any station that already has a cooling fan installed and "medium" priority to any stations that do not currently have a cooling fan. Implementation for these upgrades is recommended in the 0 to 5 year timeframe. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

4.3.3 Piping

Shaft Seal Water Piping and Valves

1. **Convert Copper Piping to PVC** – This upgrade has been recommended to increase the reliability of the shaft seal water line by minimizing the amount of pipe that can be damaged by corrosion.

   As much of the existing copper main line and branch piping as possible would be converted to PVC. This requires the removal of existing piping and providing new piping, fittings and pipe supports.

   For FPS where Pipe and/or Joint condition is in J0-J1/C0-C1 condition, this upgrade has been assigned as Not Required since the piping is essentially in like-new condition and

replacement is not justified. If condition is at C2-C3 (or J2-J3), replacement is recommended within 6 to 10 years and a medium priority has been assigned. C4 (or J4) or higher has the replacement recommended within 0 to 5 years and high priority assigned. Costs have been assigned such that if one line (i.e. main line or a branch line to a single pump) is in questionable condition, the entire station's piping is replaced in order to provide consistency within the station. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

2. **Replace Existing Valves** – This upgrade has been recommended to increase the reliability of the valving on the shaft seal line by minimizing the chance that valving will leak or cannot function due to corrosion.

   The existing main line valves (strainer, check, solenoid, PRV, gate valves) and the branch line valves to each pump (swing check and gate valves) would be replaced for this upgrade. This would require removal of all existing valves and installation of new ones.

   For FPS where seal water valving is at C0-C1, this upgrade is Not Required since the valve condition is not in a state that warrants replacement. For ratings at C2-C3, replacement is recommended within 6 to 10 years and a medium priority has been assigned. With C2-C3 rated valves, a replacement should be anticipated every 20 years. C4 or higher requires replacement in 0 to 5 years and subsequent replacement should be allowed for every 10 years. A high priority has been assigned to any valving in C4 or higher condition. Costs have been assigned such that if valves on one line (i.e. main line or a branch line to a single pump) are in poor condition, the entire station's valving is replaced to provide consistency within the station. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

3. **Replace Copper Pipe at Drywell Entry Point** – This upgrade has been recommended to increase the reliability of the piping on the shaft seal line by minimizing the chance that this section of piping will leak or can be lost due to corrosion.

The section of piping at the drywell entry point prior to the shutoff valve would be replaced for this upgrade. This would require excavation outside the station to expose the City water line, coring of the drywell wall to allow installation of a new tie-in section of piping, sealing and abandonment of the existing wall penetration, and tie-in of the existing water line to a new section of piping within the drywell.

For FPS where copper piping at the entry point to drywell is C0-C3, this option is Not Required. For a C4 condition rating the priority is low with replacement recommended within 11 to 50 years. Subsequent replacements can be expected every 20 years. For C5 condition ratings the priority is medium with, replacement recommended at 6 to 10 years and subsequent replacements every 20 years. FPS C6 ratings have been given a high priority with rating, 0 to 5 years recommended as the replacement time and subsequent replacements every 10 years. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

4. **Replace Copper Pipe at Tie-In Point to Pumps** – This upgrade has been recommended to increase the reliability of the piping on the shaft seal line by minimizing the chance that this section of piping leaks or can be lost due to corrosion.

The section of piping at the tie-in point to each pump would be replaced for this upgrade. This would require removal of the existing spool piece and replacement with a new piece. Some minor thread repair at the FNPT port on the pump may also be required as part of this work due to corrosion.

For FPS where copper piping at the tie-in point to each pump rated between C0-C3, this option is Not Required. For a condition rating of C4 to C5 the replacement is recommended at 11 to 50 years and can be expected every subsequent 20 years. For ratings, C4 installations have been assigned a low priority and ratings while C5 have been assigned a medium priority. For any C6 ratings a high priority has been assigned, with a 0 to 5 years replacement anticipated and subsequent replacements at 10 year intervals. Costs have been assigned such that if the tie-in to one pump is in poor condition, all tie-ins are replaced to provide consistency within the station. Estimated 10

year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

Flood Pump Piping

1. **Replace Flood Pump Victaulic Couplings and/or Flange Nuts and Studs** - This upgrade has been recommended to increase the reliability of the flood pump system by minimizing the chance of leakage or loss of line pressure due to joint failure.

   For instances where victaulic couplings or their mounting hardware are corroding, replacement of the coupling is recommended. Wherever flanged connections have been assigned a C4 or higher rating, replacement of the mounting nuts and bolts is recommended. For flanged connections, it is assumed the entire circle of hardware would be replaced to establish a consistent condition rating for the pump.

   For FPS where flanges or victaulics are rated C0-C3, this upgrade is Not Required. For installations rated C4, a 6 to 10 year replacement time is recommended with subsequent replacements every 30 years. For any flanges rated C5 or greater, a 0 to 5 years replacement time is assigned with subsequent replacements at every 20 years. C4 rated installations have been assigned a medium priority and C5 rated installations have been assigned a high priority due to this component's importance in the overall flood pump system. Costs associated with purchase of a new victaulic coupling are fairly high, therefore only the couplings that must be replaced have been included in the cost estimate (no attempt has been made to establish consistency among all pumps at an FPS for this upgrade measure). Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

2. **Discharge Pipe Replacement** – Analysis of ultrasonic test data suggests that Jessie P106 and Jessie P107 are in poor condition.

   Discharge piping replacement would require removal of the existing victaulic coupling and flanged connection, as well as removal of the grout around the existing discharge pipe at the drywell wall. A new 30" spool piece would then be installed, c/w a new

flanged connection on one end. This pipe would be grouted into the drywell wall and coupled to the existing discharge line by reusing the existing victaulic coupling.

The recommendations for discharge piping were based on the methods described in ASME B31G-1991. This analysis procedure provides for the calculation of the ratio of P'/Pw where P' = the calculated safe maximum pressure for the corroded section of piping and Pw = the actual working pressure of the system (assumed at 24 psi or 55 ft. water). For P'/Pw = 3.1 and greater, ultrasonic monitoring was recommended at 10 year intervals (this is the category that all of the tested lines fell under with the exception of Jessie P106 and P107). For P'/Pw = 2.1 to 3.0, ultrasonic monitoring is recommended at 5 year intervals and replacement of piping should be allowed for at 20 to 50 years. Jessie P106 discharge had P'/Pw=2.9 while P107 had P'/Pw = 3.0.

Pipe replacement for this item has been assigned "low" priority since ultrasonic monitoring is being recommended at 5 year intervals. In addition, it was judged that the anticipated 20 to 50 year replacement time did not justify assignment of a medium or high priority to this upgrade.

4.3.4 Flood Pumps

Bearing Cover Hardware Replacement

This upgrade has been recommended to increase the reliability of the pumps by minimizing the chance that this component can experience leaks or loss of pressure due to corrosion of the mounting hardware.

Wherever bearing cover mounting hardware is in poor condition, it is recommended that the entire circle of studs and nuts be replaced. It is assumed that some thread repair at the FNPT holes on the pump will also be required as part of this work due to corrosion damage.

For FPS where bearing cover hardware is rated C0-C3 condition, this upgrade is Not Required. For installations with a C4 rating, replacement is anticipated at the 11 to 50 year period with subsequent replacements at 20 year intervals. Hardware with a C5 rating should be replaced in 6 to 10 years with subsequent replacements every 20 years. For hardware with a C6 rating, a

0 to 5 year replacement is recommended with subsequent replacement intervals allowed at every 10 years. C0-C4 ratings have been assigned a low priority, C5 a medium priority and C6 has been assigned high priority. Costs have been assigned such that if the hardware on one pump's bearing cover is in poor condition, all pumps at the station will have their bearing cover hardware replaced to provide consistency within the station. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

Packing Gland Cover Hardware Replacement

This upgrade has been recommended to increase the reliability of the pumps by minimizing the chance that this component can experience leaks or loss of pressure due to corrosion of the mounting hardware.

Wherever packing gland cover mounting hardware is in questionable condition, both studs and nuts are recommended for replacement. It is assumed that some thread repair at the FNPT holes on the pump may also be required as part of this work due to corrosion damage.

For FPS's where packing gland cover hardware is rated C0-C3 this upgrade is Not Required. For installations with a C4 rating, replacement is anticipated at the 11 to 50 years period with subsequent replacements allowed for at 20 year intervals and a priority assignment of "low" for the upgrade. For Hardware with C5 rating a 6 to 10 year replacement and medium priority is recommended with subsequent replacements allowed for at every 20 years. For Hardware with C6 condition rating, it is recommended that high priority be assigned and a 0 to 5 year replacement with subsequent replacement intervals allowed at every 10 years. Costs have been assigned such that if the hardware on one pump's packing gland cover is in poor condition, all pumps at the station will their packing gland cover hardware replaced to provide consistency within the station. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

Packing Gland Cover Replacement

This upgrade has been recommended to increase the reliability of the pumps by minimizing the chance that this component can experience leaks or loss of pressure due to corrosion damage.

Wherever a packing gland cover is in poor condition, the cover is recommended for replacement.

For FPS where packing gland covers are rated C0-C3 condition, this upgrade is Not Required. For installations with a C4 rating, the priority is assigned as low and replacement is anticipated at the 11 to 50 year period with subsequent replacements at 20 year intervals. Covers with C5 ratings are assigned a medium priority and should be replaced in 6 to 10 years with subsequent replacements every 20 years. Covers rated at C6, are assigned a high priority and replacement is recommended for 0 to 5 years with subsequent replacement intervals allowed at every 10 years. Costs have been assigned such that if one pump's packing gland covers is in poor condition, all pumps at the station will have their packing gland cover replaced to provide consistency within the station. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

Pump Bushing Clearance Assessment

This upgrade has been recommended based on analysis of the vibration test data. The pumps requiring attention are Jefferson P53, P54, P56 & P57, St. Johns P26 & P27, Metcalfe P29 & P30 and Bannatyne P8. Pump bushing clearances at these locations need to be properly adjusted. Further details on the vibration testing that was performed are located in Appendix C – Pump Shaft Vibration Testing Report.

This upgrade has been assigned a high priority and should be performed as soon as possible to correct the problem and restore the system to good working condition. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

4.3.5 Line Shaft Assemblies

The following upgrades have been recommended based on analysis of the vibration test data. (Further details on the vibration testing that was performed are located in Appendix C – Pump Shaft Vibration Testing Report.)

Shaft Bearings and Universal Joints – Vibrational analysis indicated that worn shaft bearings and universal joints were present at Cornish P103. These bearings and universal joints are recommended for replacement.

Shaft - Vibrational analysis indicated that a bent shafts are present at Jefferson P56 & P57, St. Johns P24 and Baltimore P26. These shafts should be removed and either straightened or replaced.

Shaft Bearing Clearance – Vibrational analysis indicated that the shaft bearing does not clear the shaft coupling due to thermal expansion when the system is in operation at Laverendrye P1. The shaft bearing has been installed too close to the flanged connection. The shaft bearing should be lowered slightly to correct this problem.

Shaft Condition – Vibrational analysis indicated that the line shaft is in strain at Hart P1. The shaft should be disassembled and strain relieved before placing back into service.

Shaft Alignment – Vibrational analysis indicated that the line shaft is out of alignment at Syndicate P10. The shaft should be properly aligned before placing back into service.

The upgrades recommended in this Section have been assigned a high priority since these are problems that get progressively worse with continued operation of the flood pump system. The upgrades should be performed as soon as possible to correct the problems and restore the systems to good working condition. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

4.3.6 Sandblasting and Painting

Several of the key mechanical elements in Permanent FPS and LDPS drywells are vulnerable to corrosion. Flood pumps, flood pump suction and discharge piping, lineshafts, and metallic shaft seal line piping would all benefit from coatings that act as a barrier between the base metal and the drywell environment.

Prior to paint application, the existing paint must be removed. This process is complicated by the fact that (with the exception of Mayfair) lead-based paint was used when these systems were installed in the 1950s and 60s. The most cost efficient way to remove this paint is to first apply a chemical stripper to the surfaces and scrape off as much paint as possible. This stripped material has to be treated as hazardous waste and disposed of appropriately. Once the surfaces are chemical stripped, sandblasting is performed to remove any remaining paint and bring the surface to bare metal. The advantage of first using a chemical strip is that the volume of waste is minimized as compared to sandblasting alone. If only sandblasting was performed, the entire volume of spent blast media would have to be treated as hazardous waste, rather than just the strips of paint and chemical that are disposed with the proposed method.

The recommended coating system for an FPS application is a zinc rich primer followed by a high build epoxy primer and a final corrosion resistant top coat. This system will provide the corrosion resistance necessary as well as the toughness to resist normal wear and tear such as wrenches impacting piping or similar conditions that can be expected in an FPS. The proposed coating system is expected to last 40 to 50 years.

Pricing for this option was based on estimates provided by Carlson Sandblasting and PPG Phillips Coatings, who visited two representative FPS's in January 2005. The Sandblast and Painting Upgrade was applied to any FPS that had a Flood Pump Suction Pipe, Discharge Pipe, or Pump Bowl paint condition that had deteriorated to a P2 Paint Condition rating or worse. The upgrade is recommended to be performed in the next five years. FPS's where paint is rated at a P2-P3 condition have been assigned a Medium priority, while P4-P6 rated installations have been assigned a High priority. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

4.3.7 Monitoring

Ultrasonic Testing

All Permanent FPS and Ravelston LDPS are recommended for ongoing ultrasonic test-based monitoring program. Temporary FPS have do not require this testing since they do not contain permanently installed piping. Ultrasonic testing of the station's suction and discharge piping will

have the dual benefit of detecting immediate problems as well as establishing a baseline thickness reading for future reference. This baseline reading would allow future ultrasonic test analyses to benefit from information not only on how thick the pipe wall is at the time of test, but also at what rate the pipe has corroded since the previous tests.

Dumoulin, Jessie, Linden and Newton stations were ultrasonic tested in January 2005. All other stations that were not tested in 2004/05 should be tested as soon as possible. Subsequent ultrasonic testing would be scheduled based on how severely a pipe had deteriorated as determined through the previous round of testing.

Due to the fact that FPS are operated sporadically, annual ultrasonic testing is not considered justifiable. The recommended interval for ultrasonic testing was based on the ASME B31G-1991 derived ratio of P'/Pw where P' = the calculated safe maximum pressure for the corroded area of piping and Pw = the actual working pressure of the system (assumed at 24 psi or 55 ft. water). For P'/Pw = 3.1 and greater, ultrasonic monitoring was recommended at 10 year intervals. This is the category that all of the tested lines fell under with the exception of Jessie P106 and P107. For P'/Pw = 2.1 to 3.0, ultrasonic monitoring is recommended at five year intervals and replacement of piping should be considered at 20 to 50 years. Jessie P106 discharge had P'/Pw=2.9 while P107 had P'/Pw = 3.0, therefore this station is recommended for ultrasonic testing every five years. Estimated 10 year and future upgrade costs for the ultrasonic monitoring program are included in the summary cost estimate table discussed in Section 5.0.

Vibration Testing and Thermal Scanning

It is recommended that an ongoing vibration analysis and thermal scanning based monitoring program be developed for all Permanent FPS's. Although thermal scanning detects electrical problems, it is mentioned in this mechanical section because it is typically performed during the same site visit as vibration testing. Vibration testing and thermal scanning will have the dual benefit of detecting immediate problems, as well as establishing a baseline test signature for future reference. This baseline reading would allow future rounds of testing to benefit from information not only on how pronounced a problem was at the time it was tested but also to what extent a component has degenerated (or improved if a problem was detected and then remedied) since the previous rounds of testing.

All Permanent Flood Pumping Stations were tested in 2004-05 with the exception of Ash, Assiniboine, Aubrey, Clifton, Cockburn, Colony, Galt, Mager, Marion and Mayfair. These stations cannot be tested until the following problems are corrected:

Ash The first attempt to test this FPS was made on May 2, 2005. The cable to lift the flap gate broke, therefore either a larger cable or an alternate approach is required.

Assiniboine Outfall is plugged.

Aubrey No cable attachment point is currently available on the flap gate.

Clifton No cable attachment point is currently available on the flap gate.

Cockburn This station was scheduled for testing on May 2, 2005, however it was determined it would take a day to pump out the gate chamber. Gate chamber pumpout or an alternate approach is required to test this station.

Colony An attempt to test this FPS was made on April 20, 2005 but the flap gate could not be opened. An alternate lifting system is required in order to test this station.

Galt This station was not available due to construction. Status to be reviewed prior to scheduling of future testing.

Mager This station was not available due to construction. Status to be reviewed prior to scheduling of future testing.

Marion No cable attachment point is currently available on the flap gate.

Mayfair The first attempt to test this FPS was made on April 18, 2005. The gate chamber could not be pumped out enough to lift the flap gate. It is suspected that this was due to silting of the outfall.

Due to the fact that FPS are operated sporadically, annual vibration testing and thermal scanning is judged to be not justifiable. For FPS that have not been tested in 2004/05, we recommend correction of the problems discussed above followed by testing. It is then recommended that all FPS receive subsequent vibration testing and thermal scanning as part of an ongoing monitoring program that retests each station at 10 year intervals. Estimated 10 year and future upgrade costs are included in the summary cost estimate table discussed in Section 5.0.

4.3.8 Mechanical – Estimated Costs

The basis for the estimated mechanical costs is described in Section 5.0.

Probabilities have been assigned to the cost of some items to account for necessary upgrades projected in the future (i.e. 11 to 50 years), which are difficult to assign to a specific station at this time. Probabilities were assigned to each Upgrade Item using the following criteria:

1. **Drywell Ventilation System Upgrade** – This is a "one time only" upgrade and replacement of the upgraded system within the 50 year life of the station is not anticipated. The cost for regular maintenance is not included in this estimate.

2. **Main Floor Cooling Fan System Upgrade** – This is a "one time only" upgrade and replacement of the upgraded system within the 50 year life of the station is not anticipated. The cost for regular maintenance is not included in this estimate.

3. **Convert Copper Piping to PVC Upgrade** – This is a "one time only" upgrade and replacement of the upgraded system within the 50 year life of the station is not anticipated. The cost for regular maintenance is not included in this estimate.

4. **Replace Existing Seal Water Valving Upgrade** – In an FPS where this upgrade measure has been considered, a probability of 75% has been assigned indicating that there is a 75% chance that this item will need to be replaced within the 50 year life of the station. In FPS where valving is in very good condition (C0-C1), this item has not been included in the Future Upgrade Cost estimate.

5. **Replace Flood Pump Victaulic Coupling and/or Flanged Connection Nuts & Bolts** - In FPS where this upgrade measure has been allowed for, a probability of 75% has been assigned. In FPS where hardware is in excellent to good condition (C0-C3), this item has not been included in the Future Upgrade Cost estimate.

6. **Sandblasting & Painting Upgrade** – This is a "one time only" upgrade and additional major repainting is not anticipated within the 50 year life of the station. The cost for regular maintenance is not included in this estimate.

7. **Bearing Cover Hardware Replacement** - In an FPS where this upgrade measure has been considered, a probability of 75% has been assigned, indicating that there is a 75% chance that this item will need to be replaced within the 50 year life of the station. In FPS where hardware is in good to good condition (C0-C3), this item has not been included in the Future Upgrade Cost estimate.

8. **Packing Gland Cover Hardware Replacement** - In FPS where this upgrade measure has been considered, a probability of 75% has been assigned indicating that there is a 75% chance that this item will need to be replaced within the 50 year life of the station. In FPS where hardware is in excellent to good condition (C0-C3), this item has not been included in the Future Upgrade Cost estimate.

9. **Packing Gland Cover Replacement** - In FPS where this upgrade measure has been allowed for, a probability of 50% has been assigned. In FPS where the cover is in excellent to good condition (C0-C3), this item has not been included in the Future Upgrade Cost estimate.

10. **Replace Copper Pipe on Shaft Seal Line at Tie-In to Pump(s)** - In FPS where this upgrade measure has been allowed for, a probability of 75% has been assigned. In FPS where the piping is in excellent to good condition (C0-C3), this item has not been included in the Future Upgrade Cost estimate.

11. **Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point** - In FPS where this upgrade measure has been allowed for, a probability of 75% has been assigned. In FPS where the piping is in excellent to good condition (C0-C3), this item has not been included in the Future Upgrade Cost estimate.

12. **Discharge Pipe Replacement** – At FPS's that have been Ultrasonic Tested, a probability has been assigned based on analysis of the data. At FPS that have not tested, the results of the first four station (Jessie, Dumoulin, Linden, Newton) tests were considered as a representative sample of four FPS that were known to be in poor condition. This sample group indicated that approximately 20% of these stations had significantly thinner discharge pipe thicknesses. Other FPS have been assumed to have piping in better condition than the representative sample, therefore 15% probability of discharge pipe replacement has been assigned per pump (i.e. in a station with two pumps the probability of requiring discharge pipe replacement is 2 x 15 = 30%).

13. **Replace Worn Shaft Bearing and Universal Joints /**
Straighten or Replace Bent Shaft /
Access Pump Bushing Clearances and Correct /
Lower Shaft Bearing to Clear Shaft Coupling /
Disassemble Shaft , Relieve Strain /
Align Misaligned Shaft Upgrade – These upgrades are all recommended based on analysis of the Vibration Testing. At FPS that have been Vibration Tested, a probability has been assigned based on analysis of the data. At FPS that have not tested (Ash, Assiniboine, Aubrey, Clifton, Cockburn, Colony, Galt, Mager, Marion, Mayfair), the results of the first 17 stations were considered as a representative sample of FPS that were in normal condition. This sample group indicated that the probability of these problems occurring was:

Replace Worn Shaft Bearing and Universal Joints – 1 in 30 or 3.3% per pump
Straighten or Replace Bent Shaft - 4 in 30 or 13.3% per pump
Access Pump Bushing Clearances and Correct – 10 in 30 or 33.3% per pump
Lower Shaft Bearing to Clear Shaft Coupling - 1 in 30 or 3.3% per pump
Disassemble Shaft , Relieve Strain - 1 in 30 or 3.3% per pump
Align Misaligned Shaft - 1 in 30 or 3.3% per pump

Based on this assessment a station that has not been vibration tested and has 4 pumps will have a 3.3% x 4 = approx. 10% probability of Requiring Replacement of Worn Shaft Bearings and Universal Joints.

results of all inspections should be documented in a database format maintained by the Department.

The recommended inspections will provide a consistent method and procedure for monitoring the performance of riverbanks and outfall pipes. If any problems are observed such as increased bank erosion rates, active instability, or pipe damage then appropriate repairs and/or increased monitoring should be undertaken as required. If potential riverbank stability problems are discovered and corrected while they are still relatively minor then the required repairs are less costly and the likelihood of a sudden deep-seated significant riverbank failure are reduced significantly.

4.4.3 Slope Inclinometers

Installation and monitoring of slope inclinometers is recommended for the Ash, Dumoulin, Galt, Jessie, Roland, Selkirk, and Syndicate flood pumping stations. The installations are recommended for one of three reasons: i) to verify the effectiveness of existing bank stability improvement works previously constructed at the sites (e.g. Dumoulin), ii) to replace existing slope inclinometers which have exceeded their measurement range (e.g. Galt), or iii) to monitor possible historic bank instability in the vicinity of the FPS (e.g. Syndicate). Monitoring of the instrumentation should be performed a minimum of one to two times per year depending on the site.

Additional monitoring of the slope inclinometers installed by KGS Group as part of this study at the Colony, Despins, Hawthorne, Marion, and St. John's FPS should also be performed. The additional monitoring will provide useful data to confirm potential movement rates and trends as well provide a basis for the design and implementation of any required bank stability improvement works.

Detailed recommendations for frequency and duration of monitoring at each of the candidate sites are given in Appendix B. Depending on the monitoring results, it may be necessary to adjust the proposed monitoring frequencies or rates in the future or potentially undertake bank repairs to address ongoing instability.

4.4.4 Regrading and Drainage Improvements

Most of the FPS's have positive surface drainage to the river with respect to the potential for water ponding and groundwater surcharge in the bank. However at two stations (Assiniboine and Newton) minor surface erosion or potential for ponding was observed at should be repaired by regrading and revegetation work.

4.4.5 Riprap

Placement of new rockfill riprap erosion protection or upgrading of existing riprap erosion protection is recommended for most of the FPS sites. Rockfill riprap is an effective and economic method of reducing the potential for bank erosion such as toe scour and undercutting, which can lead to riverbank instability. As discussed previously in Section 3.4.3.1 most FPS have some form of existing riprap erosion protection in place locally around the outfall pipes. However at most of these locations the extent of the existing riprap is limited leaving the banks immediately upstream and downstream susceptible to erosion, which could lead to potential riverbank instability at the FPS in the future. In some instances the existing riprap does not extend below the winter river level leaving the toe of slope vulnerable to erosion. Placement of new riprap blankets upstream and downstream of the existing riprap over an increased bank length and in some cases below the winter river level will provide improved long term erosion protection and reduce the potential for future bank instability.

At some sites such as Assiniboine and Jessie, there are already an extensive riprap erosion protection blankets in place along the shoreline that extend a significant distance upstream and downstream of the site. In most cases the existing riprap consists of quarried limestone rockfill. At some locations the limestone riprap is supplemented with pieces of concrete rubble. In general, the existing riprap blankets have performed well in terms of providing effective erosion protection along the bank. However some degradation (breakdown and fracturing) of the existing limestone rockfill was observed at most locations due to weathering and freeze-thaw cycles and further degradation should be anticipated over the remaining life of the stations. If excessive breakdown and fracturing of the existing riprap occurs the material could in the future become too small in size to provide adequate erosion protection and upgrading (replacement) of the riprap will be required.

The degradation rate of the rockfill is difficult to predict and is largely a function of the quality and size of limestone that was originally installed at the station. As-built records relative to materials testing data on riprap (such as absorption, LA abrasion, soundness, gradation) and size of material used are not readily available and in some instances not available at all.

For budget planning purposes we have estimated the degradation rate of existing riprap blankets based on the length of time the material has been in place and its current condition based on visual inspection. Based on this we have approximated the timeframe for potential riprap blanket replacement into two categories: i) within the next 10 years or ii) beyond 10 years time. The recommended site inspections and monitoring outlined in Section 4.4.2 will provide further information relative to the performance and potential degradation rate of existing riprap. This information can be used to refine future replacement costs and construction timing.

Construction of new riprap blankets and/or upgrading of existing blankets must be performed in the winter with the river at its natural elevation. A City of Winnipeg Waterway Permit and environmental screening from the Federal Department of Fisheries and Oceans will be required for all sites.

4.4.6 Shear Key

Construction of shear keys plus installation of extensive riprap blankets is recommended for the Colony, Despins, Marion, Selkirk, and St. John's stations. These sites show evidence of either ongoing or historic instability and the proposed bank works are considered necessary by KGS Group to provide an adequate Factor of Safety against sliding under extreme conditions. The scope and extent of the bank works required at each site is included as part of the detailed site assessments in Appendix B.

Construction of shear keys must be performed in the winter with the river and its natural level and are subject to the same permit approvals and screening noted above.

4.4.7 Cost Estimate

The estimated costs for the recommended geotechnical upgrades for all FPS are summarized in Table 5.1. The cost estimates are based on recent construction tenders received for similar work plus KGS Group experience in completing numerous riverbank monitoring and stabilization projects along Winnipeg riverbanks in the past. A summary of the estimated costs (excluding 20% contingency and 20% Engineering / Administration) for each improvement category is outlined below.

Visual Inspection and Monitoring Costs – The 10 year total estimated cost for all stations is $118,000. The cost includes inspection of the riverbank, internal inspection of the outfall pipes and documentation of the results. The estimate future (11 to 50 year) cost is $480,000.

Slope Inclinometers – The estimated 10 year cost to monitor existing slope inclinometers and/or install and monitoring new slope inclinometers is $201,000. The cost includes performing the required measurements, drilling (in the case of new installations) plus a summary report detailing an interpretation of the results. The total future (11 to 50 year) costs for slope inclinometer monitoring is $16,000.

Regrading and Drainage Improvements – The estimated 10 year cost for regrading and drainage improvements is relatively minor at $5,000. No future regrading / drainage improvement works are anticipated at the FPS assuming the other recommended geotechnical upgrading measures (e.g. riprap placement) recommended in this report are performed.

Riprap – The estimated 10 year total cost for construction of new riprap blankets or upgrading of existing riprap blankets at the applicable FPS sites is $704,000. Future (11 to 50 year) costs are estimated to be $312,000.

Shear Keys – The 10 year cost to construct riverbank stability improvement works such as shear keys at high risk FPS site is estimated to $1,250,000. The future (11 to 50 year) cost allowance for sites that could become categorized as high risk in the future is $125,000.

4.5 SUBSTRUCTURES AND GATES

4.5.1 General

Estimated substructure and gate cost allowances for all anticipated items requiring repair, replacement or upgrading over the next 50 years is presented in Section 5.0. The repair and upgrade recommendations to extend the functional life of the substructure and gates are described in the following sections.

4.5.2 Substructure

Main Floor Slab

The majority of stations had only minor hairline cracks at random locations throughout with a few additional cracks propagating from the bases of the motors. In general these appear to be shrinkage cracks from the original construction and/or freeze/thaw cycling and are not a structural concern. Therefore no repairs are required.

Grade Beams

In general, any minor hairline cracks are not a concern but the medium and larger cracks, as well as any spalled areas, should be repaired to prevent moisture infiltration and to maintain structural integrity. Remove loose deteriorated concrete on spalled surfaces and along structural cracks. Inject structural cracks with epoxy resin and patch all repair areas with grout.

Hatches, Stairs & Ladders

As discussed in the Building & Site assessment, the structural adequacy of the wood hatches should be reviewed. Pending a structural review, replace any damaged or inadequate material and any damaged/missing lifting handles. The man access hatches, stairs and ladders have been addressed in the Building & Site assessment.

Drywell Walls

An external waterproofing system is the most effective means of preventing seepage in foundation walls. However, these systems are relatively expensive to install on an existing foundation, particularly considering the significant depth of excavation required for many of the station substructures. Therefore epoxy crack injection is recommended as a cost effective method for reducing wall seepage. The epoxy also bonds the cracked surfaces together, thereby restoring the structural integrity. This can readily be performed from inside the drywell since the majority of the wall surfaces are accessible (except for Ravelston, which is lined with rigid insulation).

Loose deteriorated concrete at spalled locations and along structural cracks should be removed and all repair areas patched with grout. It is difficult to predict the extent of the required repairs since it is anticipated that the degree of active wall seepage may increase significantly during the springtime thaw. Therefore conservative repair allowances have been assumed at this time.

Drywell Floor

The existing trenches are marginally effective, can be a tripping hazard, are aesthetically undesirable and also compromise the concrete cover for the slab reinforcing steel. Loose deteriorated concrete at spalled locations and along the trenches should be removed. The concrete surface should be prepared and epoxy bonding agent applied. A new concrete floor topping should then be cast with an adequate slope to the existing sump pit.

Drywell Beams

A small number of beams at the various stations have spalled areas that are still in need of repair. Loose deteriorated concrete should be removed at spalled locations. Sandblast any exposed reinforcing steel and then patch all repair areas with grout.

Pump Bases

Some of the pump bases have been repaired in the past but many require additional attention. Loose deteriorated concrete should be removed at spalled locations on the concrete bases.

Sandblast any exposed reinforcing steel and then patch repair areas with grout. Any loose or fractured base plate grout should be removed and replaced. New grout pads are required at several locations where the base plates have separated from the concrete bases or where previous repairs were done poorly.

Discharge Box

Condensation results when warm moist air comes into contact with a relatively cold surface. The likely source of the moisture is the discharge pipe connections to the heated drywell area or standing water in the downstream outfall pipe. The addition of vents (or unplugging of existing vents) near the top of the discharge box should naturally prevent the accumulation of warm moist air in this space if cool air can flow in from the outfall pipe (when the station is not operating). Some discharge boxes already have vents but may not be able to draw air from the outfall depending on river levels, therefore an alternate source may have to be considered. Removable vent covers may be required to control odours at some stations.

Loose deteriorated concrete at spalled locations and along structural cracks should be removed. Any exposed reinforcing steel should be sandblasted and the repair areas patched with grout. Inject structural cracks with epoxy resin and patch with grout, particularly below grade level. Hairline cracks are not considered to be structural and do therefore do not require repair.

The discharge stoplog guides at Hart, Polson and Selkirk are heavily corroded with significant section loss. The poor condition of the guides at these stations could restrict the installation or removal of the stoplogs. The guides should be wire brush cleaned and/or sandblasted to facilitate thickness measurements of the remaining material. Pending the extent of the deterioration, the guides may have to be reinforced or replaced.

Any accumulated debris should be removed from the floor slab area. Security screens should be installed on the outfall pipes (some pipes already have screens) to prevent unauthorized people from accessing the discharge boxes.

Access Platforms

New structural steel platforms should be installed in the drywells to provide access to the pump shaft guide mounts for regular mechanical maintenance. The platforms should be located at the level of the existing intermediate concrete support beams and accessed from the existing stairway/ladder. Platforms should have a grated surface and standard handrails.

Wetwell Concrete

The majority of the wetwell concrete is in a good to fair condition. Any minor hairline cracks are not a concern, but the medium to large cracks as well as spalled areas, with and without exposed rebar should be repaired to prevent moisture infiltration and to maintain structural integrity. Loose deteriorated concrete along structural cracks and on spalled surfaces should be removed. Structural cracks should be injected with epoxy resin and all repair areas patched with grout. The wetwell floors that have large accumulations of silt and debris should be cleaned out and inspected.

Wetwell Trashracks

The trashracks prevent large debris from entering and damaging the pumps and/or blocking the inlet pipes. The trashracks with heavy corrosion and damage require replacement or additional trashracks added. The majority of the trashracks have large amounts of silt and debris covering them and they should be cleaned and inspected to better determine the condition they are in and what repairs or upgrades they require.

Wetwell Slide Gate Shafts and Guide

The wetwells with slide gates and shafts should be tested to see if they are in working order. Since the gates were submerged and were not accessible it has been assumed that the slide gate shafts that are in a good condition should indicate the condition of the gates also. The damaged slide gates and shafts should be repaired or replaced.

Wetwell Ladders and Railings

The ladders and railings provide access and safety in the wetwells. The ladders and railings with heavy corrosion and section loss should be replaced. Ladders and/or railings should be extended or added in areas where access is currently limited or where safety is a concern.

4.5.3 Gates

Flap Gates

19 of the flap gates inspected were still in a Good condition, five were rated as Good/Fair and two of the flap gates were in a Fair condition. No immediate repairs are required for any of these gates. However it is likely that a number of these gates will require refurbishment or replacement within the next 50 years. Therefore a future allowance has been included in the estimates.

Four of the flap gates were rated as Fair/Poor. Other than a wire brush cleaning of the existing gate sealing face, no other immediate repairs are required. However it is likely that these gates will require refurbishment or replacement within the next 20 years. Therefore a future allowance has been included in the estimates.

Two of the flap gates were in a Poor condition (Hawthorne & Aubrey). Both of these gates have not been replaced since the original construction. The existing flap gate and frame should be removed and discarded. The existing corroded thimble should be wire brush cleaned and/or sandblasted in place and a new protective surface coating applied. A new flap gate complete with new anchor bolts should be installed.

Slide Gates

Nine of the slide gates were observed to be in a Good condition. No immediate repairs are required for any of these gates. A nominal future allowance has been included in the estimates.

One slide gate was rated as Good/Fair. No immediate repairs are required for this gate. However it is possible that it will require refurbishment or replacement within the next 50 years. Therefore a future allowance has been included in the estimates.

Eight of the slide gates were considered to be in a Fair condition. No immediate repairs are required for these gates, except possibly the anchor bolts, which are addressed below. However it is likely that these gates will require refurbishment or replacement within the next 30 years. Therefore a future allowance has been included in the estimates.

Six of the slide gates were rated Fair/Poor. No immediate repairs are required for these gates, except possibly the anchor bolts, which are addressed below. However it is likely that these gates will require refurbishment or replacement within the next 20 years. Therefore a future allowance has been included in the estimates.

Eight of the slide gates were determined to be in a Poor condition. These existing slide gates, frames and operators should be removed and refurbished or replaced within the next 6 to 10 years, except if anchor bolt repairs are required, which should be performed as soon as possible.

Refurbishments should include wire brush cleaning and/or sandblasting to remove all corrosion and then the application of a new protective surface coating. Any damaged wedge blocks, wedge bolts and sealing strips should be replaced as required. The existing corroded thimble should also be wire brush cleaned and/or sandblasted and a new protective surface coating applied. The refurbished slide gate & frame should be re-installed complete with new anchor bolts. Two of these stations (Selkirk & Linden) may be considered for a complete refurbishment in the short-term since many of the anchor bolts are sheared and require immediate attention.

At least nine of the slide gates had anchor bolts that were sheared. This varied from only one bolt to virtually all bolts along the top and sides of the gate frame. New anchor bolts should be installed adjacent to the existing sheared anchor bolt locations as soon as possible. The cause of the anchor bolt damage should be investigated further and preventive measures should then be implemented to avoid future repairs.

Gate Chamber Concrete

Four of the gate chambers were found to be in a Fair condition and one was rated Fair/Poor. Loose deteriorated concrete should be removed at spalled locations and along structural cracks in these chambers. Any exposed reinforcing steel should be sandblasted and the repair areas patched with grout. Inject structural cracks with epoxy resin and patch with grout as required. At Aubrey the concrete tunnel between the flap gate and the slide gate is in a Poor condition and likely should be replaced.

Some chambers have accumulations of silt and/or debris that should be removed. For example at the Marion FPS the slide gate can not close since there is over 3 ft of silt in the chamber

Additional Unidentified Scope Items

An allowance for miscellaneous items that may arise during the implementation of the upgrade program has been included.

4.6 ELECTRICAL

4.6.1 Main Service

Where the information on available fault currents rating of existing equipment is not available and the available fault current is judged to be an issue, it is recommended that the electrical distributions for the sites be upgraded to ensure that there is not a failure in the event of a significant fault.

An allowance has also been provided to cover the costs of refurbishing the existing ITE breakers (49 in total) at all stations. From the investigation (Appendix F) this equipment has been shown capable of meeting its original specifications if refurbished.

4.6.2 Lighting

Lighting generally has a limited lifespan. Where fixtures have not been recently replaced, it is recommended that they be upgraded with other major work over the course of the next 10 years. There will also be a requirement to upgrade all lighting over the course of the next 50 years. Allowances for both of these items have been provided in the cost estimate.

4.6.3 Additional Unidentified Scope Items

Generally, there will be minor electrical upgrades required over the course of the next 50 years. These will be generally small upgrades such as conduit replacement and minor re-wiring where required. These items are have not been specified as they are relatively small scope items and have been covered by a general allowance.

IMPLEMENTATION PLAN

5.0 ESTIMATED COSTS AND IMPLEMENTATION PLAN

5.1 TOTAL ESTIMATED UPGRADE COSTS AND PRIORITIES

The recommended upgrades, as shown in Table 5.1 and their estimated costs have been compiled by discipline; Building and Site, Mechanical, Geotechnical, Sub-Structure & Gates and Electrical. All of the costs shown are in 2005 dollars and have not been escalated for future costs (i.e. the 11 to 50 year cost estimates are still in 2005 dollars). These estimates include engineering, administration and contingencies. The recommended upgrades have been prioritized by the following categories:

- 0 to 5 year implementation
- 6 to 10 year implementation
- Future upgrades (i.e. 11 to 50 years)

Table 5.1 shows the estimated costs for the next 10 years (i.e. 2006 to 2016) and the cost estimated for the remaining 50 year life of the stations (i.e. 11 to 50 years) for each of the 29 station assessments. The costs and priorities, for each individual station, are given in Tables 5.2 to 5.33. Total estimated costs for all stations are as follows:

- 10 year $13,479,000.00
- 11 to 50 year $8,230,000.00

A summary of these costs, allocated by work area, is shown on the Table below:

WORK AREA	0 – 10 YR ESTIMATED COSTS	11 – 50 YR ESTIMATED COST
Building and Site	$2,449,000	$1,181,000
Mechanical	$2,109,000	$1,027,000
Geotechnical	$2,282,000	$959,000
Substructures and Gates	$2,316,000	$2,317,000
Electrical	$473,000	$394,000
Sub-total	***$9,628,000***	***$5,879,000***
Contingency – 20%	***$1,926,000***	***$1,176,000***
Engineering and Administration – 20%	***$1,926,000***	***$1,176,000***
Total Estimated Cost	***$14,479,000***	***$8,230,000***
GRAND TOTAL (10 YR PLUS FUTURE COSTS)	**$21,709,000**	

Summary of Recommended Upgrade Costs by Work Area

Priorities of very high, high, medium and low have been assigned to the 10 year cost estimates. These are shown for each of the individual station cost estimate sheets on Tables 5.2 to 5.33 and reflect the relative urgency of each of the work items. Items assigned a very high priority should be completed as soon as possible, high priority items within the next 1 to 3 years and medium priority items within the next 4 to 7 years. Low priority items should be addressed within the next 10 years.

In some cases the future upgrades have been assigned a probability to reflect the uncertainty associated with the future need to undertake the work scope. The rationale for assigning probabilities to the future upgrades is described in Section 4.0 and in the individual FPS reports given in Appendix B1 to B32. The future costs and their associated probabilities (where applicable) are shown in Tables 5.2 to 5.33 for each of the individual station cost estimates.

5.2 BASIS OF COST ESTIMATE

Building / superstructure cost estimates are based on a combination of contractor estimates, past experience and recent tendered prices for similar work by the Water and Waste Department at the Flood Pumping Stations.

Estimated mechanical costs include all labour and materials necessary to complete the work described for each item. Construction labour rates of $50/hour have been applied in most cases with the exception of items such as ultrasonic testing and sandblasting/painting where labour has been "rolled" into a lump sum cost estimate provided by a contractor. Costs for major items, such as pump shafts, fans etc. have been based on equipment supplier budget quotations and our previous past experience. Estimates for surface preparation and painting are based on contractor estimates and KGS Group previous experience.

Geotechnical cost estimates are based on recent construction tenders received for similar work and KGS Group experience in completing numerous riverbank monitoring and stabilization projects in Winnipeg. Similarly, substructure and gate cost estimates are based on contractor input, recent similar WWD project tender pricing, supplier quotations and KGS experience.

Costs associated with the substructure and gate upgrades are based on recent similar work by WWD, discussions with contractors familiar with work of this nature, supplier quotations and KGS Group experience.

Electrical cost estimates are based discussions with contractors, suppliers and on engineering experience.

An allowance of 20% of the total estimated construction costs for Engineering and Administration have been included. This estimate allows for final design work and drawing production (where necessary), as well as materials or equipment selection and preparation of specifications. Contract Administration and technical assistance during the initial implementation phase are also included in this engineering allowance.

A 20% contingency has been considered in the estimate since the details of each implementation item are preliminary and could be affected by complications in the field and/or cost fluctuations of materials, equipment and labour. As well the contingency reflects the preliminary nature of the estimate at this stage.

5.3 WORK PROGRAM

The strategy for completing the upgrade works identified was discussed on a few occasions with the Steering Committee. Based on these discussions, it was concluded that a work program should be developed for the 10 year cost estimates items only (i.e. a 10 year work program). The future upgrade requirements (i.e. 11 to 50 year) would be reviewed periodically and added to an ongoing 10 year program until all of the necessary work is completed.

Based on discussions with the Steering Committee, except for addressing the high and very high priority items first, there was no clear preference as to how the work should be implemented. Two possible scenarios were discussed.

- ***Stations Basis*** – Under this scenario, tender documents for the work at each station would be developed, possibly "bundling" a number of stations together for economies of scale. It was assumed that these would be further grouped by area (i.e. South, North and East) to facilitate contractor and WWD support personnel efficiency.

- ***Work Area Basis*** – Under this scenario, the work would be separated on a work area / discipline basis, likely grouping the building and site, mechanical & electrical, substructure & gates and geotechnical work areas into separate tender work packages. Again a number of stations would be "bundled" by area for economies of scale.

Using these two work program scenarios as a guideline, implementation schedules for each scenario have been developed. These are shown on Drawings 5.1 and 5.2 for the Work Program by Station and the Work Program by Work Area scenarios respectively. For each Work Program, it has been assumed that the high and very high priority items would be completed first. For the purpose of the schedule, it has been assumed these high priority items would be completed in the first three years (i.e. 2006 to 2009). It has been assumed that the geotechnical work would be separated for each scenario due to its unique characteristics, as there would be no apparent advantage to mobilizing the geotechnical contractor with the building contractor.

Table 5.34 shows the number of high priority items per station and their estimated cost. Approximately $4.80 Million has been assigned to high priority items.

For each scenario, the work would be allocated on a yearly basis to keep the implementation costs near equal or approximately $1.4 Million per year in 2005 dollars (i.e. the 10 year cost estimated divided by 10 years). It is assumed that the work scope would be reviewed on an annual basis using these implementation objectives as a guideline. The number of stations per year would be adjusted to achieve these annual cost targets (i.e. 2 to 4 or 5 stations per year depending on the work scope per station).

As described in Section 1.3, the cost items have been compiled in a spreadsheet format readily convertible to a database. It is recommended that the database be developed following the initial review of this report by WWD. Alternate scenarios for implementation can then be developed by querying database by work area, by station or by priority. Work scope reports and preliminary cost estimates could then be generated for the alternate work scope scenarios.

RECOMMENDATIONS

6.0 RECOMMENDATIONS

6.1 WORK PROGRAM

It is recommended that the Water and Waste Department Proceed with the 10 year work program described in Section 5.0 of this report.

6.2 MONITORING

It is recommended that the Water and Waste Department proceed with the on-going monitoring programs described in this report. A number of general and specific monitoring requirements have been outlined for each of the work areas and are summarized below. Furthermore, a detailed monitoring program, as described in Section 6.3, should be developed.

6.2.1 General Monitoring

In each work area a number of items have been identified as requiring periodic follow-up inspection. These include such items as gates, pump coatings, pump shafts and casings, roofs, sidings etc., which should be inspected on a one to two year basis. Most of these general type of inspections can best be done by WWD staff based on a methodical inspection program as outlined in Section 6.3.

6.2.2 Mechanical Monitoring

Regular monitoring activities have been defined for ultrasonic testing, thermal scanning and vibration testing. These are summarized below.

Ultrasonic Testing - All Permanent FPS are recommended for ongoing ultrasonic test-based monitoring. Ultrasonic testing of a station's suction and discharge piping will have the dual benefit of detecting immediate problems as well as establishing a baseline thickness reading for future reference and follow-up.

Due to the fact that FPS are operated sporadically, annual ultrasonic testing is not considered justifiable. The recommended interval for ultrasonic testing is 5 or 10 years based on a review

of the existing ultrasonic test data (see Appendix C), analysis of this data using ASME B316 – 1991 (see Section 4.3), and engineering experience.

Vibration Testing and Thermal Scanning - It is recommended that an ongoing vibration analysis and thermal scanning based monitoring program be developed for all Permanent FPS's. Vibration testing and thermal scanning will have the dual benefit of detecting immediate problems, as well as establishing a baseline test signature for future reference. All Permanent Flood Pumping Stations were tested in 2004-05 with the exception of Ash, Assiniboine, Aubrey, Clifton, Cockburn, Colony, Galt, Mager, Marion and Mayfair. These stations are planned for testing in 2007.

It is then recommended that all FPS receive subsequent vibration testing and thermal scanning as part of the ongoing monitoring program that retests each station at approximately 10 year intervals.

6.3.2 Geotechnical Monitoring

Visual Inspection and Monitoring - A detailed visual inspection of riverbank stability conditions plus internal inspection of outfall pipes should be performed at all stations a minimum of every five years. The inspections should include an examination of the upper and lower bank stability and erosion conditions including photographic documentation. Significant changes in conditions relative to previous inspections should be noted. Internal inspection of outfall pipes should focus on observation and measurement of potential joint separations or displacements, which are indicators of potential bank instability.

Slope Inclinometers - Installation and monitoring of slope inclinometers is recommended for the Ash, Dumoulin, Galt, Jessie, Roland, Selkirk, and Syndicate flood pumping stations. This instrumentation will be used to verify the effectiveness of existing bank stability improvement works previously constructed at the sites (e.g. Dumoulin), to replace existing slope inclinometers which have exceeded their measurement range or to monitor possible historic bank instability in the vicinity of the FPS (e.g. Syndicate). Monitoring of the instrumentation should be performed a minimum of one to two times per year depending on the site.

Additional monitoring of the slope inclinometers installed by KGS Group as part of this study at the Colony, Despins, Hawthorne, Marion, and St. John's FPS should also be performed.

Detailed recommendations for frequency and duration of monitoring at each of the candidate sites are given in Appendix B.

6.3 MONITORING PROGRAM

Following WWD's review of the work program, it is recommended that a detailed monitoring and inspection program be developed. This would be an integrated program for all work areas and would include, as a minimum:

- Description of the Inspection Task and Equipment Requirements
- Inspector Qualifications
- Frequency of Inspection
- Reporting Requirements
- Notice or Alarm Threshold Indicators
- Estimated Costs for Monitoring Requiring Outsourcing (i.e. ultrasonic testing, vibration testing etc.)

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TABLES

TABLES

Table 3.1 - Condition Assessment Summary - Building and Site

Number	Flood Pumping Station	STATION BUILDING																							
		Exterior Walls										Roof													
		Framing				Exterior Cladding				Exterior Finish		Framing					Roofing					Miscellaneous			
		Wood	Brick	Conc. Block	Cond.	Wood Siding	Brick	Other	Cond.	Paint	Cond.	Wood	Steel & Conc.	Other	Framing Cond.	Slope	Felt & Gravel	SBS Mod.	Asphalt Shingles	Other	Roofing Cond.	Drain Cond.	Trim Cond.	Soffit Cond.	Trim & Soffit Finish Cond.
1	Ash		x		G/P		x		G/P		G			Steel Trusses	G	<3/12		x			G	P	G	G	G/P
2	Assiniboine	x			G		x		G		G	x			G	Flat		x			G	F	G		G
3	Aubrey		x		G		x		G		G		x		G	Flat	x				P	F	G	F	F
4	Baltimore	x			G/P	x			F	x	P	x			G	Flat	x		Mansard Parapet		F	F	F	G	G/P
5	Bannatyne	x			G		x		G		F	x			G	Flat	x				P	P	P		F
6	Clifton	x	x		G	x	x		G	x	F	x			G	<3/12	x				P	F/P	F	F	P
7	Cockburn		x		G		x		G		G	x	x		G	>4/12				Prefn. Metal	G	G	G	G	G
8	Colony		x		G		x		G		G		x		G	Flat	x				F	F	F		F
9	Cornish		x		G		x		G		G		x		G	Flat	x				P	F	F		P
10	Despins	x			G		x		G		G	x			G	Flat	x				F	G	G		F
11	Dumoulin	x			G		x		G		G	x			G	Flat		x		Prefin. Metal	G	G	G		F
12	Galt	x			G			Splitface conc. block	G		G			steel	G	>4/12				Prefin. Metal	G	G	G		G
13	Hart	x			G/P	x			G/F	x	F	x			G/P	>4/12			x		G/P	F	P	F	P
14	Hawthorne	NO BUILDING																							
15	Jefferson	x			G	x			F	x	F	x			G	Flat	x				P	P	P	P	P
16	Jessie		x		G		x		G	x	G		x		G	Flat	x				F	G	F		G
17	Larchdale (LDPS)	NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)																							
18	Laverendrye	x			G	x			G	x	F	x			G	Flat	x				F	G	F	G	F/P
19	Linden	x			G	x			F	x	P	x			G	3/12			x		P	P	P	P	P
20	Mager Drive	x			G			Stucco	G	x	F	x			G	>4/12			x		G	F	F	G	P
21	Marion	x			G		x		G		G	x			G	Flat		x			G	F	G		G
22	Mayfair			x	G		x		G		G			Steel Trusses	G	Flat		x			G	G	G		G
23	Metcalfe	x			G	x			G	x	P	x			G	>4/12			x		G	F	F	G	P
24	Mission	x			G	x			F	x	P	x			G	Flat		x			G	F/P	G/P	P	P
25	Munroe	NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)																							
26	Newton (Armstrong)	x			G	x			F	x	P	x			G	4/12			x		G	F/P	P	F	P
27	Polson	x		x	G	x			F	x	P	x			G	>4/12			x		G	P	G/P	G/P	G/P
28	Roland		x		G		x		G		G			Steel & Precast	G	Flat		x			G	P	G		P
29	Selkirk	x			G	x			G	x	P	x			G	Flat	x				P	P	F	F	P
30	St. John's	x			G	x			G	x	F	x			G	Flat	x				F	P	F	F	F
31	Syndicate	x			G		x		F		F	x			G	Flat	x				P	F	F		P
32	Ravelston	NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)																							

Condition Definitions

G - Good	G/F - Good to Fair
F - Fair	G/P - Good to Poor
P - Poor	F/P - Fair to Poor

Table 3.1 - Condition Assessment Summary - Building and Site

Number	Flood Pumping Station	STATION BUILDING												BUILDING SITE AND SECURITY									
		Doors and Windows							Interior Features and Safety Issues					Site					Security				
		Doors and Frames				Glazing & Frames								Features					Security Features			Vandalism		
		Wood Painted	Steel Painted	General Cond.	Finish Cond.	Glazing Panels	General Cond.	Finish Cond.	Stairs (Drywell Access)	Stair or Landing Hand Rail Deficiency	Ladder (Drywell Access)	Ladder Deficiency	Guard Rail Provided Around Hatches	Foamed Plastic Insul	Paved Driveway Cond.	Paved Sidewalk Cond.	Entry Stair Cond.	Fence	Site Drainage Cond.	Lights	Fence	Other	Graffiti	Damage	Theft
1	Ash	Doors	Frames	G	F				X					X		F		x	F		x					
2	Assiniboine		x	G	G					Top Rail only	x	Clearance & Cage	x	x	G				G	x			x			
3	Aubrey	x		F	F				x					x	F				F	x			x			
4	Baltimore	x		F	P	x	F	P	Steep	Clearance & Rail	x	Cage	x	x				x	P		x		x			
5	Bannatyne	x		P	F				Steep	Clearance & Rail			x	x		G		x	F				x			
6	Clifton	x		G	G	x	G	F	Steep	Clearance & Rail			x	x	G	G	G	x	F	x			x			
7	Cockburn		x	G	G				Steep	Clearance & Rail			x	x			F	x	G				x			
8	Colony	x		F	F					Clearance & Rail			x	x	F				F	x			x			
9	Cornish	x		F	F				Steep	Clearance & Rail			x	x					P							
10	Despins		x	G	G							Clearance & Cage	x	x			F		F				x			
11	Dumoulin		x	x	x				Steep	Clearance & Rail			x	x			G	x	G				x			
12	Galt			G	G					Only Top Rail	x	Clearance & Cage	x	x					G				x			
13	Hart	x		F	F	x	G	G		Only Top Rail	x	Clearance & Cage	x	x			G		F							
14	Hawthorne	NO BUILDING																								
15	Jefferson	x		G	F	x	F	P			x	Clearance & Cage	x	x	G			x	G	x	x					
16	Jessie	x		F	P				Steep	Clearance & Rail			x	x					G				x			
17	Larchdale (LDPS)	NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)																								
18	Laverendrye	x		P	F						x	Clearance & Cage		x					F				x			
19	Linden	x		F	P	x	F	P	Steep	Clearance & Rail	x	Clearance & Cage	x	x					P							
20	Mager Drive	x		F	P				Steep	Clearance & Rail	x	Clearance & Cage	x	x	F			x	F	x	x		x			
21	Marion		x	G	G				Steep	Clearance & Rail			x	x	G	G	G	x	G		x		x			
22	Mayfair		x	G	G				x				x	x					G				x			
23	Metcalfe	x		F	P						x	Clearance & Cage	x	x					F	x						
24	Mission	x		F	P				Steep	Clearance			x	x		G			F				x			
25	Munroe	NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)																								
26	Newton (Armstrong)	x		P	F	x	P	P	Steep	Clearance & Rail			x	x			G	x	F							
27	Polson	x		F	F				x	Clearance & Rail	x	Clearance & Cage	x	x	F			x	P	x						
28	Roland		x	F	F				Steep	Clearance & Rail			x	x					G				x			
29	Selkirk	x		F	F				Steep	Clearance & Rail			x	x		P	F	x	F		x		x		x	
30	St. John's	x		F	F	x	P	F	Steep	Clearance			x	x	G				F							
31	Syndicate	x		P	P						x	Clearance & Cage	x	x	G	G			F	x			x	x		
32	Raveleton	NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)																								

Condition Definitions

G - Good G/F - Good to Fair
F - Fair G/P - Good to Poor
P - Poor F/P - Fair to Poor

Table 3.1 - Condition Assessment Summary - Building and Site

Number	Flood Pumping Station	GENERAL		Additional Notes
		Aesthetics	Sanitary	
		Recommended Candidates for Aesthetic Upgrade	Building Linked to Sanitary Chamber "Combination Station"	
1	Ash			Deteriorated brick due to faulty roof drainage or failed roof membrane on east side of Hydro enclosure - Considerable deadfall on west side of roof - Rusted out rain gutter on west side of roof - Hydro enclosure felt & gravel roof covered with deadfall and in poor condition - Hydro enclosure concrete parapet
2	Assiniboine			Station exterior completely renovated around 2000 - Some ponding on roof due to location of scupper
3	Aubrey			Roof in very poor condition - Missing roof drain cover - Remove pulley type level indicator at next reroofing - Soffit overhang not serving any purpose and deteriorating due to rot (remove and redsign roof trim at next reroofing - Considerable graffiti and youths ge: on roof
4	Baltimore	x		Lower part of east wall rotting above discharge block - Exterior paint flaking badly - Rainwater leader missing - Station surrounded by chainlink fence enclosure (Yard an eyesore due to uncut grass etc.) - Although building is set back from street site is open and build ng aesthetics below standard for street
5	Bannatyne	x		Building scheduled for future exterior renovation to suit Waterfront Drive develpement - Roof in very poor condition (flooded with considerable vegetation - rusting counter flashings) - Grade above lower brick courses on west side (no noticable damage) Some exterior brick damage due to Hydro changes - Parging spalling on discharge block
6	Clifton			Roof in poor condition (considerable deadfall on main roof and discharge block rool, vegetation, bare spots) - Drainage gutters full of debris and many rainwater leaders missing - Paint flaking on siding and roof trim Potential for rot in wall above west d scharge block (no visible evidence)
7	Cockburn		x	Station roof rebuilt as sloped metal on wood trusses approximatel 10 years ago after an arson fire which destroyed original flat roofing - Complaints of steel door freezing shut in winter due to high humidity in station - No handrail on main entry stair - Station linked to sanitary chamber -
8	Colony			Face shell of much of the exterior brickwork blasted off by graffiti removal methods (may contribute to accelerated wear of brick in future) - Minor localized brick damage - Debris accumulating in wall void at Hydro enclosure - Settling at site of replaced water service to be backfilled -
9	Cornish			Some cosmetic damage to brick at removed Hydro enclosure on south side (clean & repoint brick and mortar on this side) - Roof in poor condition due to vegetation, bare spots, blisters - Drain cover missing - Building floor level with surrounding grade (some brick below grade - no noticable damage)
10	Despins			Station exterior completely renovated at least 10 years ago - Generally in good condition - Roof trim and flashing faded - Tyndall stone base around stair landing (ledge angle rusting, some shifting cracks, failed sealant joint) - Rusted handrail - Repoint localized mortar joints and reseal control joints - enlarge brick weep holes
11	Dumoulin		x	Station exterior completely renovated at least 10 years ago - Generally in good condition - Roof trim and flashing faded - No counter flashings along concrete block parapets on discharge blocks (generally good condition)
12	Galt			Station exterior was reconstructed in 2005
13	Hart			Lean-to addition over discharge block and north wall of station rotting (Repaired in past) - Roof shingles (one side almost new - the other old and in very poor condition) - White deposits on some roof framing (crystallized sap) - Some damaged siding at removed Hydro enclosure and othe localized areas - Considerable flaking paint on siding and trim
14	Hawthorne			**NO BUILDING**
15	Jefferson	x		Station houses a federal weather station (no access to room - some roof mounted equipment) - Roof drains off back edge of roof and down wall (has damaged roof trim and soffit - Roof leaking at west end - Remove sections of soffit in damaged areas (dry inside - damage limited to exterior surface and finish)
16	Jessie	x		Station has been painted repeatedly due to chronic graffiti problem - Consideration for aesthetic upgrade due to proximity to walking path - Some brick faces have spalled at courses immediately above discharge block (no curb or flashing provided)
17	Larchdale (LDPS)			**NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)**
18	Laverendrye			Small station - Existing glass block window panels covered over with painted plywood panels - Station set back from the street
19	Linden		x	Station linked to sanitary sewer chamber (above average corrosion in drywell bbut not noticable in building) - Roof well worn and in need of replacement - Uncontrolled roof run-off deteriorating fascia trim - Site built-up around building to same level as main floor (no evidence of rot at bottom of wall) - Quiet neighbourhood) - Apparently painted approximately 5 years ago but in poor condition due to failure of multiple previous paint layers (Large flaking areas - some boards replaced recently)
20	Mager Drive	x		Fenced enclosure surrounding adjacent lift station - Some fencing around tops of discharge blocks - Gravel trip hazard at entry door - Minor stucco damage on east side and south sides - Abanadoned Hydro area attached on east side
21	Marion			Station exterior completely renovated approximately 5 years ago - Tyndall stone parapet cap in good condtion but tops getting mossy - Short rainwater leader causes wall and tyndall stone shell to get wet (mossy)
22	Mayfair		x	New station built in accordance with latest codes and requirements approximately 6 years ago - Building completely insulated and heated - Numerous brick wall weep holes plugged with mortar or sealant (should be cleared to allow proper wall cavity drainage - Caulking along roof side of parapet cap debonding from galvanized flashing (remove and replace)
23	Metcalfe			Small station - Exposed sited at end of street near homes - Paint baldy flaking due to failure of previous multiple layers of paint - Grade at main floor level on 2 sides (siding does not appear damaged other than from grass cutting etc.)
24	Mission			Poor exterior finish - Relatively new roof but location of overflow allows ponding over considerable area of roof - new metal cap flashing in good condition but wood fascia underneath in poor conditon - Considerable odour in station (also report considerable condensation and icing inside during winter months) - Site relatively concealed and remote (in backyard of residence)
25	Munroe			**NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)**
26	Newton (Armstrong)		x	Station linked to sanitary sewer chamber (considerable odour - and reported condensation and ice during winter) - Poor exterior finish - 2 wall openings made (sills rotten in both - require replacement) - Glass block window sill framing rotten and requires replacement (considerable staining on inside of station especially below window)
27	Polson		x	Station linked to sanitary sewer chamber (considerable odour - and reported condensation and ice during winter) - Poor exterior finish - Rebuilt wall above discharge block and valve chambers with 150mm concrete block on 2 sides - Single plank entry step is slippery when wet - Site is relatively level and 2 sides at same level as main floor
28	Roland			Station generall in good condition - Some efflourescence on brick at discharge block - Roof drain too high and possibly plugged (approximately 40mm of water over entire roof) - some joints between wall caps require reseating
29	Selkirk			Station in fair to poor condition - Poor exterior finish due to flaking paint - Roof run-off enters top of wall at continuous screened vent condition along back of building causing rot - Metal discharge block covers stolen in past (replaced with plywood covers) - Main floor approximately 300mm below grade (no evidence or report of water entry despite cracked concrete foundation)
30	St. John's			Station generally in good condition - Recently repainted (no graffiti) - Roof drains over gravel stop on back side (runs down wall) - Wall rotting in this area between discharge blocks - Some wall deterioration on south side due to Hydro area removal - Window sills rotting - Normally considerable vandalism and damage at this site (arson and graffiti) -
31	Syndicate			Station in fair to poor condition - Front hit a number of years ago by a truck (wall slightly buckled due to impact - still visible - never really repaired) - Brick face damged by graffiti removal and carving of initials - Door frame split due to break-in - Grade on 2 sides approximately 100mm above main floor - Street slopes toward building (drain located at entry)
32	Ravelston			**NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)**

Table 3.2 - Condition Assessment Summary - Mechanical

Number	Flood Pumping Station	VENTILATION			PUMPS								PIPING																							
		Cooling Fan	Drywell Ventilation										Flood Pump Piping														Shaft Seal Water Piping									
													Suction Side			Discharge Side				Joint Corrosion**				Piping			Joints			Valves					
		Recommendation	Supply Fan Recommendation	Exhaust Fan Recommendation	No. of Flood Pumps (incl. Underwriters)	Shaft Motor HP	Vibration Test Summary	Packing Gland Cover Corrosion	Packing Gland Cover Rust/Bolt Corrosion	Packing Gland Cover Nuts / Bolts Corrosion	Bearing Cover Nuts / Bolts Corrosion	Shroud Nuts / Bolts Corrosion	Paint** (on Pump Base, not incl. Sump Pits)	Material	Corrosion**	Paint**	Material	Corrosion**	Paint**	Ultrasonic Test Summary	Suction Pipe Flanged	Suction Pipe Victaulic*	Pump Disch. Flanged	Disch. Pipe Victaulic*	Material	Corrosion**	Paint**	Type	Corrosion**	Condition	Corrosion**					
1	Ash	Install new 18000 cfm cooling fan.	Remove existing 1,200 cfm fan, install new 3,400 cfm fan.	Install new 3,600 cfm fan.	4	925	NT	C2-C4	C2-C5	NA; C3-C5	C0-C1	P4	D.I.	C2-C3	P3	NT	C.S.	C1	P1	NT	C2-C3	C2-C3; NA	C1-C2	C1	Cu	C2-C4	Cu	SOL/ THR TEF / THR	C2-C4	J2-J3	C1-C5					
2	Assiniboine	Install new 3000 cfm cooling fan.	Remove existing 700 cfm fan, install new 1,000 cfm fan.	Install new 1,100 cfm fan.	1	175	NT	C1	C1	C1	NA	P3	D.I.	C2	P2	NT	C.S.	C1	P1	NT	C1	C2	C1	NA	PVC/ Cu	C2-C3	PVC/ Cu	THR TEF/ CEM	C1-C2	J1-J2	C1-C3					
3	Aubrey	Install new 18000 cfm cooling fan.	Remove existing 1,200 cfm fan, install new 2,700 cfm fan.	Install new 2,800 cfm fan.	4	825	NT	C1-C2	C1-C2	C1-C2	C1	P2-P3	D.I.	C1	P1-P2	NT	C.S.	C1	P1	NT	C1-C4	C1-C4, J4	C1-C2	C1-C2	Cu; PVC	C2-C3	Cu/ PVC/ P1	SOL/ THR TEF/ TEF / CEM	C2-C3	J2-J4	C2-C5					
4	Baltimore	Install new 9000 cfm cooling fan.	Remove existing 700 cfm fan, install new 2,200 cfm fan.	Install new 2,300 cfm fan.	3	425	T6	C2-C3	C3-C4	C3 C4	NA; C0 C2	P3	D.I.	C2-C3	P2-P5	NT	C.S.	C2-C4	P2-P5	NT	C1 C5	C2-C5	C1-C4	C1-C3	PVC/ Cu/ C.S.	C0-C3	PVC/C u; P0	THR/TEF/ CEM/ THR	N.A/C 1-C2	J1-J2	C3-C4					
5	Bannatyne	Fan is oversized but this cooling fan should remain at this FPS.	Remove existing 700 cfm fan, install new 1,800 cfm fan.	Install new 1,900 cfm fan.	4	395	T6	C1-C2	C1	C0-C3	NA	P1-P3	D.I.	C2	P2-P3	NT	C.S.	C1-C2	P1-P2	NT	C1-C3	C1-C3	C0-C2	N.A	PVC/ Cu	C1-C4	PVC/C u	THR/TEF/ CEM	C1-C3	J1-J3	C0-C1					
6	Clifton	Transfer Linden's 14000 cfm fan to Clifton FPS.	Remove existing 1,200 cfm fan, install new 3,100 cfm fan.	Install new 3,300 cfm fan.	4		NT	C3	C1	NA	C0	P2-P3	D.I.	C1-C2	P2	NT	C.S.	C0-C1	P1	NT	C1-C3	N.A	C0	C0-C1	PVC/ Cu	C1	PVC/C u; P1	THR/TEF/ CEM / SOL	C1-C3	J1-J3	C1					
7	Cockburn	Install new 12000 cfm cooling fan.	Leave existing 1,200 cfm fan for SPS, install new 2,800 cfm fan for FPS.	Install new 2,900 cfm fan for FPS	3	600	NT	C1-C3	C1-C4	NA C3	NA; C2-C4	P2-P3	D.I.	C2-C4	P4-P5	NT	C.S.	C0-C1	P1-P2	NT	C1-C5	C1-C4	C0-C1	C0 C2	Cu; PVC	C1-C2	Cu; PVC	THR/TEF/ CEM / SOL	C1-C2	J1-J2	C1-C2					
8	Colony	Install new 8000 cfm cooling fan.	Remove existing 800 cfm fan, install new 2,200 cfm fan.	Install new 2,300 cfm fan.	2	400	NT	C0-C1	C0	C0	NA	P0	D.I.	C0	P0	NT	C.S.	C0	P0	NT	C0	J0	C0	C1/J4	Cu; PVC	C0-C1	Cu	SOL/ CEM/ THR/TEF	C0	J0	C0-C1					
9	Cornish	Install new 7000 cfm cooling fan.	Remove existing 800 cfm fan, install new 1,900 cfm fan.	Install new 2,000 cfm fan.	3	325	T6	C1	C1 C4	C2 C3	C1	P2-P3	D.I.	C1-C4	P1-P5	NT	C.S./D.I.	C1-C5	P1-P6	NT	C1-C4	C1-C2	C1-C5	C1-C2	Cu/Galv	C1	N.A	SOL/THR	C1-C3	J2-J3	C1-C2					
10	Deepdale	Install new 5000 cfm cooling fan.	Remove existing 700 cfm fan, install new 2,100 cfm fan.	Install new 2,200 cfm fan.	2	250	T0	C2-C3	C2-C3	C2 C5	NA	P2-P3	D.I.	C3	P3-P4	NT	C.S.	C1	P1	NT	C2-C4	C2	C1	N.A	PVC; Nylon;Cu	C2	PVC/N ylon/C u	THR/TEF/ CEM	C2	J2-J2	C1 C5					
11	Dumoulin	Install new 5000 cfm cooling fan.	Leave existing 2,000 cfm fan for SPS. Install new 1,000 cfm fan for FPS.	Install new 1,100 cfm fan for FPS.	2	225	T0	C1	C2-C3	C1	NA	P2-P3	D.I.	C1-C2	P2-P3	T0	C.S.	C2 C3	P3-P4	T0	C1-C4	C1-C2	C1-C2	C1-C3	PVC; Cu	C2	PVC/C u	THR/TEF/ CEM	C1	J1	C2-C3					
12	Galt	Install new 4000 cfm cooling fan.	Remove existing single speed 700 cfm fan. Install new 2 spd 900 cfm fan	Install new 1000 cfm fan.	2	150	NT	C1	C0-C2	C3-C4	NA	P1	D.I.	C2	P1-P2	NT	C.S.	C1	P1	NT	C2-C3	C1-C2	C1	N.A	Cu/ PVC	C1-C4	Cu/ PVC	THR/TEF/ CEM	C1-C2	J1-J2	C1-C4					
13	Hart	Install new 6000 cfm cooling fan.	Remove existing 700 cfm fan, install new 1,800 cfm fan.	Install new 1,900 cfm fan.	3	275	T6	C1	C1-C2	C1 C2	NA	P1-P2	D.I.	C3	P5	NT	C.S.	C1-C2	P1-P3	NT	C2-C5	C1-C2	C1	N.A	Cu/ PVC	C1-C3	Cu/ PVC	SOL / CEM / THR/TEF	C1-C4	J1 J3	C1-C4					
14	Hawthorne	This station is a subsurface chamber and does not require permanent cooling.	SUBSURFACE CHAMBER	SUBSURFACE CHAMBER	NA	NA	NT	NA	NA	NA	NA	NA	NA	NA	NA	NT	NA	NA	NA	NT	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA					
15	Jefferson	Install new 16000 cfm cooling fan.	DRYWELL 1 - Remove existing 700 cfm fan. DRYWELL 2 - Remove existing 700 cfm fan. Install new 3800 cfm 2 spd fan to service both D/W 1	Install new 4000 cfm fan to service both drywells	5	600	T6	C0-C2	C1	C1-C2	NA	P0-P1	D.I.	C2-C3	P2-P3	NT	C.S.	C1-C2	P1-P3	NT	C1-C2	C1-C2	C0-C1	N.A	Cu; PVC	C0 C2	Cu; PVC	THR/TEF/ CEM	C0-C1	J1	C1-C4					
16	Jessie	Transfer Newton's 14000 cfm fan to Jessie FPS.	Remove existing 1,100 cfm fan, install new 3,000 cfm fan.	Install new 3,100 cfm fan.	3	675	T0	C1-C2	C1-C2	NA C2	NA/C0-C2	P3	D.I.	C3-C4	P3-P5	T0	C.S.	C1-C2	P0-P3	T6	C2-C3	C2	C1-C2	C0-C2	PVC; Cu	C2-C4	Cu/ PVC	SOL/ CEM/ THR/TEF/ THR	C2-C3	J2-J3	C1-C2					

* Indicates "where applicable" - victaulic is not present on all pump suctions.
** CORROSION, PAINT, and JOINT ratings represent the range of conditions found after inspecting all pumps in the FPS wetwell

Joint Condition Definitions

J0 - Joint is like new, excellent seal

J1 - Joint is good but not optimal

J2 - Joint seal (solder/cement/teflon/threads) is slightly worn, corroded or damaged

J3 - Joint seal (solder/cement/teflon/threads) is visibly worn, corroded or damaged, but not leaking

J4 - Joint condition may be the cause of periodic leakage

J5 - Joint has a definite small leak

J6 - Joint has a definite large leak

Joint Types

VIC - Victaulic Coupling

FLG - Flanged Connection

THR - Threaded

THR/TEF - Threaded w/ Teflon Tape

SOL - Soldered

CEM - PVC Cement

CLMP - Double Hose Clamp

Materials

D.I. - Ductile Iron

C.S. - Carbon Steel

Cu - Copper Pipe / Tubing

PVC - PVC Pipe

RR - Red Rubber Hose

Corrosion Definitions

C0 - No Corrosion - Surface is in like new condition

C1 - Very minor surface corrosion - Cross section is barely affected but minor corrosion is visible

C2 - Minor Surface Corrosion - Cross section is slightly affected, corrosion is visible.

C3 - Surface Corrosion - Cross section is affected, corrosion is clearly visible.

C4 - Advanced Surface Corrosion - Cross section is decreasing, structural integrity is still acceptable.

C5 - Heavy Surface Corrosion - Due to loss of base material, structural integrity is questionable.

C6 - Extreme Surface Corrosion - Major corrosive loss with rust-through at a minimum of one location.

Ultrasonic / Vibration Test Definitions

NT - Station has not yet been tested

T0 - Test did not indicate presence of anomalies requiring corrective action.

T6 - Test indicated presence of anomalies requiring corrective action.

FOR T0 AND T6 RATED STATIONS, SEE REPORT FOR FURTHER DETAILS

Paint Condition Definitions

P1 - Very minor localized discoloration due to corrosion, paint is lightly adhering to surface

P2 - Minor discoloration due to corrosion, localized bubbling or flaking of paint

P3 - Paint is flaking due to corrosion at several locations

P4 - Large sections of painted surfaces are flaking

P5 - Most surface paint has been lost due to corrosion

P6 - Paint is completely removed from surface

Cu - Copper piping - no paint

PVC - PVC piping - no paint

Table 3.2 - Condition Assessment Summary - Mechanical

| Number | Flood Pumping Station | VENTILATION | | | PUMPS | | | | | | | | | PIPING | | | | | | | | |

Table 3.3 - Condition Assessment Summary - Geotechnical

ID No.	LOCATION	RIVER MEANDER PATTERN	OVERALL BANK SLOPE	SURFACE DRAINAGE	EXISTING BANK WORKS	EROSION CONDITIONS	BANK STABILITY CONDITION	GEOTECHNICAL ASSESSMENT RATING
1	Ash	Inside bend	5H:1V	Generally positive, some potential for ponding mid-bank downstream properties.	Discontinuous pieces of concrete rubble and limestone riprap around pipe outlets.	Minor between vegetation line and O.H.W.M. (1)	No evidence of overall instability at FPS. Inactive head scarp downstream of site.	Low Risk
2	Assiniboine	Straight	4H:1V	Positive	Riprap below Assiniboine Riverwalk.	Minor above walkway.	No evidence of overall instability at FPS.	Minimal Risk
3	Aubrey	Inside bend	5H:1V	Positive	Some limestone riprap and concrete rubble around outfall pipes.	Localized undercutting at upstream pipe outlet.	No evidence of bank instability at FPS.	Low Risk
4	Baltimore	Inside bend	6.5H:1V	Generally positive; potential for minor ponding on bank.	Grouted stone riprap locally outfall pipe.	Toe scour and undercutting upstream and downstream of pipe.	No evidence of overall instability at FPS.	Low Risk
5	Bannatyne	Start of Outside Bend	10H:1V	Positive	Timber retaining and limestone riprap	Minor above riprap	No evidence of bank instability at FPS.	Low Risk
6	Clifton	Straight	3.5H:1V	Generally positive; potential for minor ponding immediately upslope of guard rail	Combination of grouted stone and limestone riprap around pipe outlet.	Minor shoreline erosion beyond limits of riprap between RSRL & O.H.W.M. .	No evidence of bank instability at FPS.	Low Risk
7	Cockburn	Straight	4H:1V	Generally positive; potential for minor ponding at gate chamber.	Limestone riprap/toe berm extending down to glacial till.	Active erosion and shoreline slumping upstream and downstream.	No evidence of overall instability at FPS. Active and inactive head scarps upstream and downstream of FPS.	Low Risk
8	Colony	Outside bend	6H:1V	Generally positive within R.O.W.; potential for ponding along mid/lower bank upstream	Some limestone riprap	Active undercutting above riprap. Erosion extends up to O.H.W.M. and is most severe at upstream end of site	No evidence of bank instability at FPS. Historic retrogressive slope failures along midbank upstream of station.	High Risk
9	Cornish	Outside bend	7H:1V	Positive	Stone riprap	Undercut and over steepened above existing riprap at bridge.	No evidence of overall instability.	Low Risk
10	Despins	Outside bend	5H:1V	Positive along upper bank; potential for water ponding along mid to lower bank	Riprap in place beginning 6m downstream of outfall pipes and extending downstream to watertaxi dock; No Riprap in place at FPS shoreline.	Active, tree roots exposed, bank moderately undercut	Active shallow slumping along shoreline extending 3 to 5 m upslope of outfall pipe outlet. Inactive head scarp along top of bank approximately 8 to 12 m downslope of station.	High Risk
11	Dumoulin	Straight	7H:1V	Positive	Limestone riprap and 6 m shear key	Active downstream of riprap	No evidence of overall instability at FPS.	Minimal Risk
12	Galt	Outside bend	8H:1V	Positive	Limestone riprap	None	No evidence of overall instability at FPS.	Minimal Risk
13	Hart	Inside bend	6H:1V	Generally positive, potential minor ponding riverside of FPS foundation wall.	Limestone riprap around pipe outlet; some concrete rubble downstream	Undercutting downstream	No evidence of overall instability at FPS; shallow slumping along shoreline.	Low Risk
14	Hawthorne	Outside bend	6H:1V	Positive	Reconstructed in 2006 with new rockfill riprap and rockfill columns to act as a shear key	None	No evidence of overall instability at FPS.	Low Risk
15	Jefferson	Outside bend	12H:1V	Positive	Grouted stone riprap and concrete wall structure around pipe outlet.	Active with exposed tree roots upstream of outfall.	No evidence of overall instability at FPS.	Low Risk
16	Jessie	Outside bend	6H:1V	Positive	6 m wide rockfill shear key and riprap blanket	None	No evidence of overall instability at FPS	Low Risk
17	Larchdale	NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)						
18	La Verendrye	Straight	4H:1V	Positive	Riprap blanket	Active undercutting beyond limits of riprap.	No evidence of overall instability at FPS; shallow shoreline slumping beyond limits of riprap.	Low Risk

Table 3.3 - Condition Assessment Summary - Geotechnical

ID No.	LOCATION	RIVER MEANDER PATTERN	OVERALL BANK SLOPE	SURFACE DRAINAGE	EXISTING BANK WORKS	EROSION CONDITIONS	BANK STABILITY CONDITION	GEOTECHNICAL ASSESSMENT RATING
19	Linden	Inside bend	4.5H:1V	Positive	Limestone and concrete rubble riprap around pipe outlet.	Minor above riprap, tree roots exposed and undercut.	No evidence of overall instability at FPS.	Low Risk
20	Mager Drive	Straight	7H:1V	Positive	3m shear key, 8m wide granular ribs, riprap blanket.	Minor beyond limits of riprap	No evidence of overall instability at FPS; historic head scarps upstream and downstream.	Minimal Risk
21	Marion	Straight	6H:1V	Positive	Riprap in place downstream of pipe and extending to bridge. Riprap in place upstream at rowing club.	Active shoreline erosion above pipe outlet	Inactive deep-seated failure extending to top of bank extending from station to 100 m upstream.	High Risk
22	Mayfair	Straight	3H:1V	Positive	Limestone riprap	Active undercutting upstream of riprap.	No evidence of overall instability at FPS; shallow shoreline slumping upstream of riprap.	Low Risk
23	Metcalfe	Outside bend	5H:1V	Positive	Limestone riprap	None	No evidence of overall instability at FPS.	Minimal Risk
24	Mission	Straight	8H:1V	Positive	None	Minor	No evidence of overall instability at FPS.	Minimal Risk
25	Munroe	**NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)**						
26	Newton	End of outside bend	3H:1V	Potential for ponding along upper bank	Riprap between RSRL and WRL	Minor above existing riprap, upstream bank undercut and over steepened	No evidence of overall instability at FPS	Low Risk
27	Polson	Inside bend	5.5H:1V	Positive	Grouted stone riprap.and shear key at outlet.	Active upstream and downstream of pipe.	No evidence of overall instability at FPS; shallow shoreline slumping upstream of riprap.	Low Risk
28	Roland	Outside bend	7H:1V	Positive	Limestone riprap in place along shoreline from CPR bridge to outfall pipe	Minor shoreline erosion above existing riprap	No evidence of instability at FPS. Historic instability upstream and downstream of site.	Low Risk
29	Selkirk	Outside bend	7H:1V	Positive at station; potential for ponding upstream	Stone riprap 10m downstream of pipe and 5m upstream of pipe	Minor above riprap	Inactive head scarps 100 m upstream of FPS. Inactive head scarp along mid bank area immediately downstream of station.	High Risk
30	St. John's	Outside bend	5H:1V	Positive	Grouted stone riprap and concrete collar at pipe outlet. Some limestone either side of grouted stone.	Minor beyond limits of riprap	Potential inactive slump block along O.H.W.M. Inactive slope failure upstream.	High Risk
31	Syndicate	Straight	2.5H:1V	Positive	Grouted limestone riprap and concrete collar around pipe outlet.	Active undercutting and over steepening upstream and downstream of outfall.	No evidence of overall instability at FPS; possible inactive scarps upstream and downstream.	Low Risk
32	Ravelston	**NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)**						

Notes: 1. O.H.W.M. - Ordinary High Water Mark

Table 3.4 - Condition Assessment Summary - Substructures & Gates

		STATION SUBSTRUCTURE																	GATE CHAMBER							
			Stairs / Ladders					Dry Well		Pump Bases				Discharge Box						Flap	Slide					
Number	Flood Pumping Station	Grade BM Cracks & Spalling	Steep	Low Rails	Angle bracket support	Insulation too close (rung/rail)	Other	Wall Cracks	Floor Swale	Exposed Reinforcing Steel	Spalled Grout Shoulder	Abolts& baseplate	Pump Flange Bolts	Wall Cracks	Wall/Roof Condensation	Roof Cracks & Spalling	Guides Corroded	Other	Concrete	Gate	Frame	Gate	Frame	Anchor Bolts	Operator	Additional Notes
1	Ash		X	X				Minor			X		X							G	G	P	F/P	P	G	Steel Shims Protruding From Grout pad- Corroded
2	Assiniboine					X	X	Minor	X	X				Minor		Medium	Medium	X		G	G/F	G/F	G/F		G	No Handrails(Drywell Access Hatch)- Discharge box access ladder heavily corroded at the top rungs
3	Aubrey	Minor	X																P	P	P	F	F	P	G	Concrete Chamber(bif gates)- Poor Condition
4	Baltimore	Minor	X	X				Minor	X		X	Heavy	X	Medium			Medium			G	G	F	F/P	P	P	Motor base pad(Spalled)-Shaft/Mount(Corroded) -Steel Shims Protruding From Grout pad- Corroded
5	Barnatyne	Minor	X	X	X			Minor		X	X			Large	X	Medium	Medium	X		G/F	G	G	G		G	Steel Shims exposed(dump base)- Underside of roof slab anchor bolts/angle support(no embedment&corroded)
6	Clifton	Minor	X								X		X		X					F/P	F/P	F	F	P	G	
7	Cockburn		X	X				Minor			X	Medium	X			Minor		X		G	G	G	G		G	Steel rebar/plate protruding from discharge wall - corroded
8	Colony	Large	X	X			X	Minor						Minor	X	Minor		X	F	G/F	G/F	F	F		G	Top concrete stairs(spalled/cracked)- Lower platform checkered plate corroded-Dry Well Wall Minor cracks out multiple stains & segregation -Pump grout base single crack- Past restoration work (wall opening, sidewall) exposed reinforcing steel-loadner discharge box wall exposed reinforcing steel corroded- Good concrete chamber minor cracks & past injections
9	Cornish		X				X	Minor				Minor a bolt	X	No access permitted						G	G	P	F/P		G	Lower stair platform top of checkered plate corroded - Toe plate 2" high on platform
10	Despins							Minor	X			Medium	X		X	Minor	Minor			G	G	G	G		G	Pump hatch missing handles - Dry well walls minor cracks and multiple patching & stains- Inside face of pump base mechanically chipped out- Top of CMP spalled & exposed reinforcing steel
11	Dumoulin		X	X		X		Minor	Minor			Minor a bolt	X			Minor		X		G	G	G	G		G	Multiple minor cracks main floor- Minor floor swale chipped out (2.5 ft length) near sump pit- Inside face of pump base mechanically chipped out- Snap ties original wall (discharge box) construction corroded
12	Galt					X	X	Minor			X		X	Medium		Minor	Medium	X		F	F	F/P	F/P	P	F/P	Minor cracks/spalled grout pad shaft- Deformity of dry well wall from poor construction(bulge) no visible signs of cracking- Dry well wall base (near ladder) concrete chipped out-Steel shims protruding from grout pad (corroded)- Gates concrete chamber medium cracks and spalling
13	Hart	Minor					X		X		X						Heavy			F/P	F/P	P	P		P	Dry well walls previously patched & multiple stains- Grout pad and steel shims rough shape on pump base- Outfall concrete chamber spalled off areas
14	Hawthorne	NOT APPLICABLE (NEW SUBSURFACE CHAMBER CONSTRUCTED IN 2006)																	F/P	G	G	P	P	P	F/P	Both concrete gate chambers have large horizontal cracks & spalling and poor concrete mixing
15	Jefferson	Minor				X	X	Medium			X				X		Medium	X		G	G	G	G		G	No Handrails(Drywell Access Hatch)- Continuous crack running from interior grade beginning the slab up to 3 motor (from east)- Exposed reinforcing steel on dry well wall- Snap ties from original construction corroded - Stoplog sheared off
16	Jessie	Minor	X	X						X				Minor						G	G	P	F		G	Multiple minor cracks on dry well floor
17	Larchdale	STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)																								
18	Laverendrye						X	Minor		X	X		X	Medium	X		Medium			G	G	G	G		G	No Handrails(Drywell Access Hatch)- Grout pad (shaft mount) top face minor spalling at shoulder- Dry well floor slab chipped and gouges
19	Linden		X	X			X	Minor	X		X	Medium	X	Minor	X	Medium	Medium			G/F	F/P	P	P	P	P	Underside of intermediate beam(dry well) exposed reinforcing steel corroded- Shaft mounts/baseplate/anchor bolts; surface corrosion-Underside of beam near column dry well wall structural cracks-Snap ties corroded(dry well & discharge box wall)
20	Mager Drive		X	X	X		X	Minor	X	X	X	Minor			X	Minor	Medium			G	G	G	G		G	Underside of one intermediate beam(dry well) exposed reinforcing steel corroded- Shaft mounts/baseplate/anchor bolts; surface corrosion- Minor cracks concrete chamber and concrete segregation present
21	Marion		X	X	X			Minor		X	X	Medium a bolt	X	Minor	X	Medium	Medium			G/F	F	F/P	F/P		P	Underside of intermediate beams(dry well) exposed reinforcing steal corroded- Near hatch opening underside of roof slab and corner exposed reinforcing steel
22	Mayfair																			G	G/F	F	F		F/P	Top of base grout shoulders minor cracks - vertical/horizontal
23	Metcalfe							Minor			Major	Minor	X		X					G	G	G	G		G	Top of wall exposed reinforcing steel corroded - spalled area
24	Mission	Minor	X	X					X			Minor	X	Large		Medium	Medium			F	F	F	F		F/P	Larger Horizontal cracks (1/8") on exterior wall of Discharge box area- Outfall concrete chamber appears to be in rough shape- Multiple large cracks in tunnel and chamber (wide cracks and various location concrete spalling)
25	Munroe	STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)																								
26	Newton		X	X	X			Minor		X	X	Heavy		Minor	X	Medium	Medium			G/F	G/F	F/P	F/P	P	F/P	Spalling of main floor slab near drywell access stairs and chipped concrete- Motor grout pad in poor spalling- 3rd beam (from east dry well wall) underside reinforced steel bars (stirrups) corroded-Two columns North dry well wall larger crack and spalling at corner edge (exposed reinforcing steel corroded) Steel shims protruding from grout pad corroded
27	Polson	Medium					X	Minor	X	X	X	Medium a bolt		Minor	X	Medium	Heavy			G	G/F	F/P	F/P		G	No Handrails(Drywell Access Hatch)-Wood trim frame along the hatch opening(discharge box) rotting Outfall gate chamber spalling at foot level north corner
28	Roland		X					Minor		X					X	Minor				(East)G	G	P	P		G	(Shaft mounts)anchor bolts and steel plates appear corroded/section loss (visual)-
																				(west)G	G	G	G		G	
29	Selkirk	Large	X	X	X			Minor		X				Medium		Medium	Heavy	X	F	G	G/F	P	P	P	P	Outfall concrete chamber horizontal cracks (1/16" gap) near bottom - at the same location the concrete chamber have spalled corners and larger voids - ice forming in concrete voids and North wall horizontal crack
30	St. John's		X	X		X		Minor	X	X	X	Medium a bolt			X	Medium	Medium			F/P	F/P	F/P	F/P		G	3rd motor (from west) minor spalling and cracks in base plate grout-Dry well access hatch handle missing-
																						F/P	F/P		G	
31	Syndicate											Minor		Minor			Minor			G	G	F	F		F	Bearing baseplate of the vertical w section which supports the pipe has 1/2 " gap between the bearing plate and concrete base pump- Dry well floor minor cracks-
32	Ravelston	STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)																								

Note:

Steel Corrosion Definitions
Minor - light surface corrosion
Medium - significant surface corrosion, minimal section loss
Heavy - major corrosion with section loss

Concrete Crack Definitions
Minor - hairline cracks to 1/32" gap
Medium - approx. 1/16" gap
Large - approx. 1/8" gap and greater

Gate Condition Definitions
G - Good G/F - Good to Fair
F - Fair F/P - Fair to Poor
P - Poor

Table 3.5 - Condition Assessment Summary - Electrical
Fault Levels and Interrupting Capacity Data

No.	Flood Pumping Station	Street Address on MH Billing Records	MH Account Number	Meter Number	Connected Load	Contract Demand	ITE Breaker	Vault Transformer Size (KVA)	Pad mount Transformer Size (KVA)	Pole Mount Transformer Size (KVA)	Manitoba Hydro Transformer Impedence (%)	Calculated Fault level at 600 V bus	Switchgear Interrupting Rating		Notes
1	Ash	1059 Wellington Ave	22505105900011	#92554 for 600 V to flood pumps #72574 for 240 V service to flood pumps #100356 for Sewage Lift Station	1 @ 175 HP 3 @ 250 HP	690 KVA			750 kVA						Service has been upgraded in 2006
2	Assiniboine	60 Main Street	26207006900022	#109307 is for 600 V pumps #42444 is for Park Lighting	1 @ 175 HP		*		150 KVA		4.5% Guess	3,333	10,000		
3	Aubrey	1016 Palmerston	08302101600001	#105123 is for the 600 V for the pumps #41238 is for the 240 V service #96739 is for the sewage lift station	1 @ 175 HP 3 @ 250 HP	690 KVA			? KVA				25,000		Service has been upgraded in 2004
4	Baltimore	246 Churchill Drive	2520024600001	#13810 in vault for 600 V service to flood pumps #80194 for 240 V service #18842 for 600 V service to sewage lift station	2@100 HP 1@225 HP	317 KVA			? KVA				25,000		Service has been upgraded in 2004
5	Bannatyne	10 Bannatyne Ave	19204001000001	#91952 for 600 V to pumps #47668 for 240 V service	2@ 125 HP 1@ 100 HP 1@ 45 HP	295 KVA	*		500 kVA		4.50%	11,111	25 kA Main 15 kA Subs		
6	Clifton	1256 Wolseley	02319125600001	#90413 is for 600 v for pumps #93259 is for 240 v service #90186 is for 600 V to sewae Lift Station	1@ 10 HP 4 @ 200 HP	649 KVA	*	3 @333 KVA		3 @37.5 KVA 1 @ 25 kVA			unknown		Carry $65,000 for future service (no transformers.)
7	Cockburn	905 Cockburn Street	01516090500001	#90107 in vault for 600 V service to flood pumps #49419 for 240 V service	1@ 150 HP 1@200 HP 1@250 HP	448 KVA	*	3@ 250 KVA		1 @ 37.5 kVA			unknown		Carry $65,000 for future service (no transformers.)
8	Colony	32 Mostyn Pl	23203003200001	#90424 is for 600 V pumps #93438 is for 240 V service	1 @ 175 HP 1 @ 225 HP	298 KVA			300 kVA	1@ 100 kVA non dedicated			25 kA Main		Cutler Hammer Panel
9	Cornish	85 Cornish St.	26309008500001	#105129 is for 600 V to pumps #1694 is for 240 V service #34424 is for 240 V for area lighting	1 @ 50 HP 1 @ 125 HP 1 @ 150 HP	243 KVA			300 kVA	3 @ 37.5 kVA			25 kA		Cutler Hammer Panel
10	Despins	151 Despins Tache & Despins	243037-020	#369746	1 @ 100 HP 1 @ 150 HP		*					7,500	15 kA Subs		Assume 300 KVA
11	Dumoulin	705 Tache Tach & Dumoulin	663037 020	#391402	1 @ 75 HP 1 @ 150 HP		*					7,500	15 kA Subs		Assume 300 KVA
12	Galt (Alexander)(Robert)	1 Galt Avenue	14217000100001	#14860 is for 600 V pumps,presently removed #36211 is for the 240 V service	2 @ 75 HP	Not Applicable	*		1 @ 150 kva		4.5% Guess	3,333	25 kA Main		
13	Hart	174 Glenwood Crescent or 1 Hart	04020101740000	#105135 for 600 V service to flood pumps #81116 for service to sewage lift station	2@100 hP 1@ 75 HP	205 KVA	*		1 @ 300 kva		4.50%	6,667	15 kA Subs		
14	Jefferson	297Scotia Ave	599912 001	#635251	3@ 150 HP 2 @ 175 HP		*					20,000	25 kA Subs		Assume 1000 KVA
15	Jessie	399 Mulvey Ave	11510039900001	# 92267 for 600 V to flood pumps #14537 for 240 V service #18301 is for sewage lift station	1@ 60 HP 1@ 175 HP 2@ 250 HP KGS records say no 60 HP pump	548 KVA		3 @ 250 kva,		3 @ 100 kva NON DEDICATED	Est 4%	18,750	25kA		
16	Laverendrye	755 Tache	297037-020	#097573	1 @ 45 HP							2,500	10 kA		Assume 100 KVA
17	Linden	858 Kildonan Drive	220063-020	#098008	1 @ 175 HP 1 @ 125 HP		*					12,500	25 kA		Assume 500 KVA
18	Mager Drive	5 Mager Drive	35038-020	#686782	1 @ 200 HP 1 @ 125 HP		*					12,500	25 kA		Assume 500 KVA
19	Marion	10 Lyndal Drive	214053-020	#606874	2 @ 225 HP 1 @ 175 HP		*					12,500	15 kA Sub 25 kA sub		Assume 500 KVA
20	Mayfair	Main Street & Mayfair			1 @ 200 HP, 1 @ 7.5 HP				1@ 500 KVA		0.04	12,500	35 kA Main 25 kA Subs		
21	Metcalfe	242 Metcalf	559951-001	#496875	2 @125 HP		*					6,000	15 kA		Assume 300kVA
22	Mission	91 Archibald at Mission	413159-021	#682276	3 @ 125 HP		*					12,500	15 kA		Assume 500kVA
23	Munroe	NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)													
24	Newton (Armstrong)				1 @ 125 HP 1 @ 150 HP		*				Est. 5%	10,000	20 kA Main Subs 15 kA		Assume 500 kVA
25	Polson	75 Scotia St.	07412007500001	#105042 for 600 V to pumps #104257 for 240 V service	2@ 100 HP 1@ 125 HP	243 KVA	*		1 @ 300 kva		4.50%	10,700	35 kA Main 15 kA Subs		
26	Ravelston	NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)													
27	Roland	16 Watt St.	07213001600001	#18316 is for the 600 V to pumps #84949 is for 240 V service	1 @ 5 HP 2 @ 150 HP	265 KVA			3 @ 150 kva	1 @ 25kVA	Est. 3%	15,000	18 kA		
28	Selkirk	100 Selkirk	28423010000001	#89977 is for 600 V for pumps #58753 is for 240 V service	2 @ 75 HP 2 @ 175 HP	373 KVA	*		1 @ 500 kva		4.50%	14,400	35 kA Main 15 kA Subs		
29	St. John's	2 Anderson Avenue	08414000200011	No meter for 600 V pumps #446933 for 240 v service	2 @ 75 HP 2 @ 175 HP	373 KVA	*		1 @ 500 kva		4.50%	14,400	35 kA Main 15 kA Subs		
30	Syndicate	200 Syndicate	08205020000001	#18563 is for 600 V pump loads #89369 is for 240 V srvice # 6583 is for the sewage lift station	1 @ 35 HP 1 @ 75 HP	None	*			3 @ 50kVA 1 @ 25kVA	3%	5,000	15 kA		
31	Hawthorne				2 @ 220 HP				500 kva			12,500	25 kA		New Station 2006
32	Larchdale (S/FPS)	NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)													

Table 4.1 - Aesthetic upgrade Candidates Summary - Building Superstructure

NO.	STATION NAME	PRESENT EXTERIOR FINISH	PROPOSED AESTHETIC UPGRADE COMMENTS & DETAILS	CONSIDERATIONS AFFECTING AESTHETIC UPGRADE RECOMMENDATIONS
1	Ash	Brick	Minor cosmetic repair	Generally in good condition - medium visibility
2	Assiniboine	Brick	Upgrade completed approximately 5 years ago	
3	Aubrey	Brick	Minor cosmetic repair	Generally in good condition - Does not blend into neighbourhood
4	Baltimore	Wood Siding (Painted)	**AESTHETIC UPGRADE RECOMMENDED**	In poor condition - high visibility - newer homes
5	Bannatyne	Brick	**MAJOR AESTHETIC UPGRADE RECOMMENDED**	Scheduled for upgrade as part of Waterfront Drive Development
6	Clifton	Wood Siding (Painted)	Medium cosmetic repair	Generally in good condition - blends in reasonably well with neighbourhood
7	Cockburn (C)	Brick	Recent prefinished metal roof	In good condition
8	Colony	Brick	Minor cosmetic repair	Generally in good condition - blends in reasonably well with neighbourhood
9	Cornish	Brick	Minor cosmetic repair	Generally in good condition - blends in reasonably well with neighbourhood
10	Despins	Brick	Upgrade completed approximately 10 years ago	
11	Dumoulin (C)	Brick	Upgrade completed approximately 10 years ago	
12	Galt	Brick	Upgrade completed spring of 2005	
13	Hart	Wood Siding (Painted)	**AESTHETIC UPGRADE RECOMMENDED**	In poor/fair condition - discharge block enclosure is rotten and must be removed
14	Hawthorne	**NO BUILDING**		
15	Jefferson	Wood Siding (Painted)	Medium cosmetic repair	Generally in good condition - blends in reasonably well with neighbourhood
16	Jessie	Brick (Painted)	Minor cosmetic repair	Generally in good condition - near walking path but in isolated industrial area
17	Larchdale		**NOTE: STATION WAS REMOVED FROM SCOPE OF WORK**	**(NOT A TYPICAL FLOOD PUMPING STATION)**
18	La Verendrye	Wood Siding (Painted)	Medium cosmetic repair	Industrial neighbourhood - medium visibility
19	Linden (C)	Wood Siding (Painted)	Medium cosmetic repair and construction of separate entry	In fair condition - medium visibility - blends in reasonably well with neighbourhood
20	Mager	Stucco (Painted)	**AESTHETIC UPGRADE RECOMMENDED**	In fair condition - medium visibility, incorporate sanitary station in new design
21	Marion	Brick	Upgrade Completed Approximately 5 years ago	
22	Mayfair (C)	Brick	New Station	
23	Metcalfe	Wood Siding (Painted)	Medium cosmetic repair	Generally in good condition - high visibility at front yard of newer home
24	Mission	Wood Siding (Painted)	Medium cosmetic repair	Low visibility - located in back yard of one older isolated residence
25	Munroe		**NOTE: STATION WAS REMOVED FROM SCOPE OF WORK**	**(NOT A TYPICAL FLOOD PUMPING STATION)**
26	Newton (C)	Wood Siding (Painted)	**AESTHETIC UPGRADE RECOMMENDED**	In poor/fair condition - close to street - requires construction of separate entry
27	Polson (C)	Wood Siding (Painted)	**AESTHETIC UPGRADE RECOMMENDED**	In poor/fair condition - close to street - requires construction of separate entry
28	Roland	Brick	Minor cosmetic repair	Generally in good condition - high visiblity - in mixed neighbourhood
29	Selkirk	Wood Siding (Painted)	**AESTHETIC UPGRADE RECOMMENDED**	In poor/fair condition - close to street
30	St. John's	Wood Siding (Painted)	Medium cosmetic repair	Generally in fair condition - in park setting
31	Syndicate	Brick	**AESTHETIC UPGRADE RECOMMENDED**	In poor/fair condition - high visibility
32	Ravelston		**NOTE: STATION WAS REMOVED FROM SCOPE OF WORK**	**(NOT A TYPICAL FLOOD PUMPING STATION)**

Notes:
1. (C) - Denotes Combination Station (Station includes sanitary function within same structure)

Definitions

1. Major Aesthetic Upgrade	Complete reconfiguration and upgrage of station and site, including complete removal of existing exterior cladding and finish and replacement with appropriate new material and finish system.
2. Aesthetic Upgrade	Complete removal of existing exterior cladding and finish and replacement with appropriate new material and finish system. May or may not include reconfiguration of roof.
3. Minor cosmetic repair	Replace/repair/refinish as required any trim and other exterior surfaces
4. Medium cosmetic repair	Strip existing paint to bare wood, replace damaged siding and repaint with high quality exterior paint. Replace/repair/refinish any trim as required. Consider medium tone colour scheme.

Table 4.2 - Summary Of Upgrade Measures - Geotechncial

ITEM	ASH FPS		ASSINIBOINE FPS		AUBREY FPS		BALTIMORE FPS		BANNATYNE FPS		CLIFTON FPS		COCKBURN FPS		COLONY FPS		CORNISH FPS		DESPINS FPS		DUMOULIN FPS		GALT FPS		HART FPS	
	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades
Visual inspection of riverbank and outfall pipe	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Install and monitoring new inclinometers	X																				X		X			
Monitoring of existing inclinometers															X	X			X	X						
Install new riprap blanket / Upgrade existing riprap blanket	X		X	X	X			X				X		X	X		X		X						X	
Drainage Improvements			X																							
Shear Key - trench															X											
Shear Key - rock columns																			X							
Replace retaining wall										X																
Other Geotechnical																										

ITEM	HAWTHORNE FPS		JEFFERSON FPS		JESSIE FPS		LARCHDALE FPS *		LAVERENDRYE FPS		LINDEN FPS		MAGER DRIVE FPS		MARION FPS		MAYFAIR FPS		METCALFE FPS		MISSION FPS		MUNROE FPS *		NEWTON FPS	
	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades			10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades			10 Year Upgrade	Future (10 to 50 Year) Upgrades
Visual inspection of riverbank and outfall pipe	X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X
Install and monitoring new inclinometers					X																					
Monitoring of existing inclinometers	X	X											X		X	X										
Install new riprap blanket / Upgrade existing riprap blanket			X			X			X			X			X			X				X			X	
Drainage Improvements																									X	
Shear Key - trench																										
Shear Key - rock columns															X											
Replace retaining wall																										
Other Geotechnical																										

ITEM	POLSON FPS		ROLAND FPS		SELKIRK FPS		ST. JOHN'S FPS		SYNDICATE FPS		RAVELSTON FPS *	
	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades	10 Year Upgrade	Future (10 to 50 Year) Upgrades		
Visual inspection of riverbank and outfall pipe	X	X	X	X	X	X	X	X	X	X		
Install and monitoring new inclinometers			X		X				X			
Monitoring of existing inclinometers					X	X	X					
Install new riprap blanket / Upgrade existing riprap blanket	X			X	X		X		X			
Drainage Improvements												
Shear Key - trench												
Shear Key - rock columns					X		X					
Replace retaining wall												
Other Geotechnical												

Note: * Station was removed from scope of work (Not a typical Flood Pumping Station)

Table 5.1 - Summary Of Estimated 10 Year & Future Upgrade Costs

Item	B1 ASH FPS		B2 ASSINIBOINE FPS		B3 AUBREY FPS		B4 BALTIMORE FPS		B5 BANNATYNE FPS		B6 CLIFTON FPS		B7 COCKBURN FPS		B8 COLONY FPS		B9 CORNISH FPS		B10 DESPINS FPS		B11 DUMOULIN FPS		B12 GALT FPS		B13 HART FPS	
	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs
Building & Site																										
Replace membrane roofing, flashing and trim (including hatch)	$ 5,800	$ 25,300	$ -	$ 9,200	$ 14,400	$ 19,000	$ -	$ 11,500	$ -	$ 11,500	$ 18,400	$ 18,400	$ -	$ -	$ 13,800	$ 13,800	$ 10,400	$ -	$ -	$ -	$ -	$ 27,600	$ -	$ -	$ -	$ -
Replace shingle roofing c/w new underlayment (including hatch)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Roof trim repair or upgrade (including drainage system)	$ 1,400	$ 1,400	$ -	$ 1,150	$ 3,500	$ -	$ -	$ -	$ -	$ -	$ 8,100	$ -	$ -	$ 2,900	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Install new sloped prefinished metal roof & trim over existing flat roof	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Localized wood frame wall repair	$ -	$ -	$ -	$ 2,900	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,900	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,900	$ -	$ -	$ 2,900	$ -	$ -	$ 2,900
Exterior siding and/or trim refinishing	$ 3,500	$ 13,800	$ 1,700	$ 5,200	$ 1,700	$ 6,900	$ -	$ 23,000	$ -	$ -	$ 20,700	$ 27,600	$ -	$ 9,200	$ 3,500	$ 13,800	$ 2,300	$ 9,200	$ 3,500	$ 13,800	$ 2,300	$ 9,200	$ -	$ -	$ -	$ 27,600
Exterior siding and/or trim repair or replace with similar material	$ -	$ 1,750	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Major aesthetic upgrade (and/or major building repair or alterations)	$ -	$ -	$ -	$ -	$ -	$ -	$ 138,000	$ -	$ 345,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 115,000	$ -	$ -
Installation of separate access to sanitary sewer chamber	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 23,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 69,000	$ -	$ -	$ -	$ -	$ -
Replace entry door and frame	$ -	$ 1,750	$ -	$ 1,750	$ 3,500	$ 1,750	$ 3,500	$ 1,750	$ -	$ 1,750	$ -	$ 1,750	$ -	$ 1,750	$ 3,500	$ 1,750	$ 3,500	$ 1,750	$ -	$ 1,750	$ -	$ 1,750	$ -	$ 1,750	$ -	$ 1,750
Replace interior door and frame	$ -	$ 350	$ -	$ -	$ -	$ 350	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 700	$ -	$ 350	$ -	$ 350	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Remove existing window and infill wall opening	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,700	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Create/rework wall openings for ventilation upgrades	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Minor brick repair and mortar joint repointing	$ 4,600	$ 2,900	$ -	$ 1,150	$ 2,300	$ 2,900	$ -	$ -	$ -	$ -	$ -	$ 1,750	$ -	$ 1,750	$ 3,500	$ 2,900	$ 3,500	$ 2,900	$ 3,500	$ -	$ 3,500	$ 1,750	$ -	$ 1,750	$ -	$ -
Wall repair and installation of flashing at discharge block	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,700	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Sealant joint replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Install thermal barrier over foamed plastic insulation in drywell	$ 13,800	$ -	$ 8,100	$ -	$ 13,800	$ -	$ 10,400	$ -	$ 11,500	$ -	$ 13,800	$ -	$ 17,300	$ -	$ 13,800	$ -	$ 13,800	$ -	$ 8,100	$ -	$ 13,800	$ -	$ 8,100	$ -	$ 13,800	$ -
Drywell stair safety upgrade (install intermediate rails on landings)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,300	$ -	$ -	$ -	$ -	$ -	$ 3,500	$ -	$ 2,300	$ -	$ -	$ -	$ 3,500	$ -	$ -	$ -	$ 2,300	$ -
Exterior stair safety upgrade (install handrails)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ 2,300	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Driveway and/or sidewalk repair or replacement	$ 3,500	$ 2,900	$ -	$ -	$ -	$ 8,650	$ -	$ -	$ -	$ -	$ -	$ 5,750	$ 10,000	$ -	$ -	$ 3,450	$ -	$ 2,300	$ -	$ 2,900	$ -	$ 5,800	$ -	$ -	$ -	$ 2,900
Fencing repair, replacement or removal	$ 3,500	$ 1,750	$ -	$ -	$ -	$ -	$ -	$ 3,500	$ -	$ -	$ -	$ 2,900	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Site regrading	$ 3,500	$ 1,750	$ -	$ -	$ -	$ -	$ -	$ 8,100	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,200	$ -	$ 1,200	$ -	$ -	$ -	$ -	$ -	$ 2,500	$ -	$ -	$ -
Additional Unidentified Scope Items	$ 5,000	$ 5,400	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 16,500	$ 5,000	$ 30,000	$ 5,000	$ 6,100	$ 6,200	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 9,700	$ 5,000	$ 5,000	$ 5,000	$ 13,100	$ 5,000
Sub-total	**$ 44,800**	**$ 59,050**	**$ 14,800**	**$ 26,350**	**$ 44,200**	**$ 44,550**	**$ 183,000**	**$ 41,250**	**$ 394,800**	**$ 18,250**	**$ 67,100**	**$ 67,950**	**$ 57,600**	**$ 21,300**	**$ 47,800**	**$ 41,050**	**$ 42,000**	**$ 21,500**	**$ 27,600**	**$ 32,150**	**$ 107,000**	**$ 54,350**	**$ 15,600**	**$ 17,700**	**$ 144,200**	**$ 40,150**
Mechanical																										
Drywell Ventilation System Upgrades	$ 10,500	$ -	$ 6,900	$ -	$ 10,000	$ -	$ 10,000	$ -	$ 9,500	$ -	$ 10,500	$ -	$ 10,000	$ -	$ 10,000	$ -	$ 9,500	$ -	$ 10,600	$ -	$ 6,900	$ -	$ 5,100	$ -	$ 9,500	$ -
Main Floor Cooling Fan System Upgrades	$ 16,200	$ -	$ 10,900	$ -	$ 16,200	$ -	$ 12,500	$ -	$ -	$ -	$ 8,700	$ -	$ 12,500	$ -	$ 11,800	$ -	$ 11,800	$ -	$ 11,100	$ -	$ 11,100	$ -	$ -	$ -	$ 11,800	$ -
Convert Copper and Carbon Steel Shaft Seal Piping to PVC	$ 1,700	$ -	$ -	$ -	$ 1,700	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,600	$ -	$ 1,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replace Existing Seal Water Valving	$ 1,200	$ 3,600	$ 1,000	$ 1,500	$ 1,400	$ 4,200	$ 1,400	$ 4,200	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,100	$ 1,650	$ 1,200	$ 1,800	$ 1,200	$ 1,800	$ 1,000	$ 1,500	$ 1,300	$ 3,900	$ 1,400	$ 4,200
Replace flood pump pipe victaulic coupling and/or nuts & bolts	$ -	$ -	$ -	$ -	$ 9,000	$ 6,750	$ 9,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,300	$ 9,450	$ 1,400	$ 2,100	$ 500	$ 375	$ 500	$ 375	$ -	$ -	$ 500	$ 750
Sandblast & Paint Pumps & Piping	$ 43,300	$ -	$ 18,000	$ -	$ 43,300	$ -	$ 33,000	$ -	$ 66,000	$ -	$ 43,300	$ -	$ -	$ -	$ 33,000	$ -	$ 34,300	$ -	$ 34,000	$ -	$ 22,700	$ -	$ 34,000	$ -	$ 50,000	$ -
Bearing Cover Hardware Replacement	$ 900	$ 1,350	$ -	$ -	$ -	$ -	$ -	$ -	$ 900	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 500	$ 741	$ -	$ -	$ -	$ -	$ 600	$ -	$ -	$ -
Paking Gland Cover Hardware Replacement	$ 400	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ 450	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 450	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Packing Gland Cover Replacement	$ -	$ 1,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replace Copper Pipe on Shaft Seal Line at Tie- In Pump(s)	$ -	$ 400	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,300	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,300	$ -	$ -
Discharge Pipe Replacement	$ -	$ 5,400	$ -	$ 1,350	$ -	$ 5,400	$ -	$ 4,050	$ -	$ 5,400	$ -	$ 5,400	$ -	$ 4,050	$ -	$ 2,700	$ -	$ 4,050	$ -	$ 2,700	$ -	$ -	$ -	$ 2,700	$ -	$ 4,050
Replace Worm Shaft Bearing and Universal Joints	$ -	$ 2,500	$ -	$ 1,250	$ -	$ 2,500	$ -	$ -	$ -	$ -	$ -	$ 2,500	$ -	$ 2,500	$ -	$ 2,500	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500	$ -	$ -
Straighten or Replace Bent Shaft	$ -	$ 12,500	$ -	$ 2,500	$ -	$ 12,500	$ 25,000	$ -	$ -	$ -	$ -	$ 10,000	$ -	$ 7,500	$ -	$ 7,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,500	$ -	$ -
Assess Pump Bushing Clearances and Correct.	$ -	$ 2,600	$ -	$ 800	$ -	$ 2,600	$ -	$ -	$ 2,000	$ -	$ -	$ 2,600	$ -	$ 2,000	$ -	$ 1,400	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,400	$ -	$ -
Lower Shaft Bearing to Clear Shaft Coupling	$ -	$ 500	$ -	$ 250	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ 500	$ -	$ 500	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 500	$ -	$ -
Disassemble Shaft, Relieve Strain and Reinstall	$ -	$ 500	$ -	$ 250	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ 500	$ -	$ 500	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 500	$ -	$ -
Align Mesgliged Shaft	$ -	$ 500	$ -	$ 250	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ 500	$ -	$ 500	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 500	$ -	$ -
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	$ 900	$ 3,600	$ 800	$ 3,200	$ 900	$ 3,600	$ 800	$ 3,200	$ 900	$ 3,600	$ 900	$ 3,600	$ 800	$ 3,200	$ 1,900	$ 7,600	$ 800	$ 3,200	$ 800	$ 3,200	$ -	$ -	$ 2,800	$ 800	$ 3,200	$ 3,600
Vibration Test and Thermal Scan	$ 2,300	$ 9,200	$ 2,300	$ 9,200	$ 2,300	$ 9,200	$ -	$ 9,200	$ -	$ 9,200	$ 2,300	$ 9,200	$ 2,300	$ 9,200	$ 2,300	$ 9,200	$ -	$ 9,200	$ -	$ -	$ -	$ 9,200	$ 2,300	$ 9,200	$ -	$ 9,200
Additional Unidentified Scope Items	$ 12,500	$ 12,500	$ 5,000	$ 5,000	$ 12,500	$ 12,500	$ 10,000	$ 10,000	$ 12,500	$ 12,500	$ 12,500	$ 12,500	$ 10,000	$ 10,000	$ 7,500	$ 7,500	$ 10,000	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 10,000	$ 10,000
Sub-total	**$ 89,900**	**$ 57,550**	**$ 44,900**	**$ 29,350**	**$ 97,300**	**$ 80,750**	**$ 101,700**	**$ 32,000**	**$ 99,900**	**$ 34,000**	**$ 78,200**	**$ 49,800**	**$ 79,000**	**$ 54,000**	**$ 34,200**	**$ 38,900**	**$ 95,600**	**$ 30,800**	**$ 65,600**	**$ 25,516**	**$ 49,700**	**$ 21,375**	**$ 51,000**	**$ 43,300**	**$ 88,100**	**$ 31,900**
Geotechnical																										
Visual inspection of riverbank outfall pipe	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000
Install new inclinometers	$ 2,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500	$ -	$ 2,500	$ -	$ -	$ -	$ -	$ -
Monitoring of inclinometers	$ 10,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,000	$ -	$ -	$ -	$ 20,000	$ -	$ -	$ 19,500	$ -	$ 10,000	$ -	$ -	$ -
Upgrade existing riprap blanket / install new riprap blanket	$ 79,000	$ -	$ -	$ 28,000	$ 52,000	$ -	$ -	$ 21,000	$ -	$ -	$ -	$ 10,000	$ -	$ 38,250	$ 78,000	$ -	$ 62,000	$ -	$ 78,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 49,500
Drainage Improvements	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,000	$ -	$ -	$ -	$ -	$ 20,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Shear Key	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 250,000	$ -	$ -	$ -	$ -	$ 250,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Unidentified Scope Items	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Sub-total	**$ 95,500**	**$ 16,000**	**$ 9,000**	**$ 44,000**	**$ 56,000**	**$ 16,000**	**$ 4,000**	**$ 37,000**	**$ 4,000**	**$ 42,000**	**$ 4,000**	**$ 26,000**	**$ 4,000**	**$ 54,250**	**$ 352,000**	**$ 16,000**	**$ 66,000**	**$ 16,000**	**$ 352,000**	**$ 16,000**	**$ 26,000**	**$ 18,000**	**$ 16,500**	**$ 16,000**	**$ 4,000**	**$ 65,500**
Substructure & Gates																										
Repair grade beam cracks and/or spalling	$ -	$ -	$ -	$ -	$ 2,800	$ 27,500	$ 2,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Upgrade/repair drywell stairs/ladders/handrails/hatches	$ -	$ -	$ 600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,100	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,150
Inject & patch cracks in dry well concrete walls and or beams	$ 16,000	$ -	$ 5,900	$ -	$ -	$ 8,300	$ 13,900	$ -	$ 13,900	$ -	$ -	$ 10,800	$ 18,700	$ -	$ 17,200	$ -	$ 13,900	$ -	$ 10,000	$ -	$ 8,800	$ -	$ 7,400	$ -	$ -	$ -
Repair drywell floor/swale with new sloped concrete topping	$ -	$ -	$ 4,300	$ -	$ -	$ -	$ 10,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,700	$ -	$ -	$ -	$ 5,600	$ -	$ 7,800	$ -	$ -	$ -	$ 10,500	$ -
Repair spalled pump base concrete, grout and/or anchor bolts	$ -	$ -	$ 2,200	$ -	$ -	$ -	$ 4,400	$ -	$ 5,500	$ -	$ -	$ -	$ 4,400	$ -	$ -	$ -	$ 5,500	$ 2,350	$ 2,900	$ -	$ 4,000	$ -	$ 2,200	$ -	$ -	$ 2,250
Discharge box concrete repairs	$ -	$ -	$ 2,000	$ -	$ 3,075	$ 3,300	$ -	$ -	$ 6,600	$ -	$ -	$ 3,650	$ 6,400	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,100	$ -	$ -	$ -
Discharge stoplog and guide repairs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,000	$ -
Add vents to discharge box to reduce condensation	$ 2,200	$ -	$ 2,200	$ -	$ -	$ 2,200	$ -	$ 2,200	$ -	$ -	$ 2,200	$ -	$ -	$ -	$ 2,200	$ -	$ -	$ -	$ 2,200	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replace/Repair flap gate, frame, anchor bolts and/or thimble	$ -	$ 22,750	$ -	$ 8,438	$ 36,000	$ -	$ -	$ 26,000	$ -	$ 9,025	$ -	$ 58,275	$ -	$ 15,250	$ -	$ 12,250	$ -	$ 5,775	$ -	$ 21,975	$ -	$ 19,500	$ -	$ 21,975	$ 8,300	$ 49,650
Replace/Repair slide gate, frame, anchor bolts and/or thimble	$ 74,800	$ -	$ -	$ 9,788	$ 18,000	$ 54,300	$ 57,500	$ -	$ -	$ 12,550	$ 23,300	$ 69,900	$ -	$ 18,075	$ -	$ 47,925	$ 32,000	$ -	$ -	$ 20,350	$ -	$ 8,000	$ 12,500	$ 38,250	$ 73,600	$ -
Install new access platforms for pump shaft guide bearings	$ 19,200	$ -	$ -	$ -	$ 21,800	$ -	$ 11,000	$ -	$ 11,000	$ -	$ 29,900	$ -	$ 28,700	$ -	$ 10,700	$ -	$ 16,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,900	$ -
Gate chamber concrete repairs	$ -	$ -	$ -	$ -	$ 110,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 11,000	$ -	$ 10,000	$ -
Repair wetwell roof, wall and column concrete (cracks and or spalling)	$ -	$ 4,500	$ 2,250	$ -	$ -	$ 4,500	$ 4,500	$ -	$ 3,000	$ -	$ 1,500	$ -	$ -	$ 4,500	$ -	$ 4,500	$ -	$ 4,500	$ 4,500	$ -	$ 9,000	$ -	$ 4,500	$ -	$ 1,500	$ -
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)	$ -	$ 2,250	$ -	$ 2,250	$ -	$ 2,250	$ 1,500	$ -	$ -	$ -	$ -	$ 2,250	$ 1,500	$ -	$ -	$ 2,250	$ -	$ 2,250	$ -	$ 2,250	$ -	$ 2,250	$ -	$ 2,250	$ 1,500	$ -
Inspect & upgrade/repair wetwell trashracks	$ 2,500	$ 7,500	$ -	$ -	$ 2,500	$ 7,500	$ 7,500	$ -	$ 2,000	$ -	$ 2,500	$ -	$ 5,000	$ 5,625	$ 1,500	$ 5,625	$ 2,500	$ 5,625	$ 1,500	$ 3,750	$ -	$ 1,125	$ 1,500	$ 3,750	$ 1,500	$ 3,750
Upgrade/repair wetwell ladders and railings	$ 2,500	$ -	$ 3,750	$ -	$ 2,500	$ -	$ 5,000	$ -	$ 3,750	$ -	$ -	$ 7,500	$ -	$ -	$ 2,000	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ 2,813	$ -	$ 2,813	$ -	$ 3,000
Upgrade/repair wetwell slide gate shafts and shaft supports	$ -	$ 75,000	$ -	$ -	$ -	$ 75,000	$ -	$ -	$ -	$ -	$ -	$ 75,000	$ 75,000	$ -	$ 10,000	$ 37,500	$ 25,000	$ 45,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Clean wetwell floor	$ 2,500	$ -	$ 1,500	$ -	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Unidentified Scope Items	$ 8,000	$ 5,000	$ 5,000	$ 5,000	$ 18,900	$ 9,300	$ 6,300	$ 7,500	$ 5,000	$ 5,000	$ 5,600	$ 16,000	$ 5,900	$ 5,000	$ 5,000	$ 8,500	$ 5,500	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 6,500	$ 13,000	$ 6,500
Sub-total	**$ 127,700**	**$ 117,000**	**$ 29,700**	**$ 25,475**	**$ 214,000**	**$ 191,725**	**$ 130,400**	**$ 33,500**	**$ 52,950**	**$ 26,575**	**$ 65,000**	**$ 243,375**	**$ 146,700**	**$ 48,450**	**$ 58,100**	**$ 118,550**	**$ 103,400**	**$ 70,500**	**$ 36,700**	**$ 53,325**	**$ 31,600**	**$ 38,688**	**$ 49,200**	**$ 75,538**	**$ 138,800**	**$ 71,300**
Electrical																										
Upgrade exterior lighting	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,000	$ 5,000	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ -	$ 2,200	$ 2,200	$ 2,200
Upgrade interior lighting	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,600	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ -	$ 1,800	$ 1,800	$ 1,800
Service entrance upgrade	$ -	$ -	$ 6,500	$ -	$ -	$ -	$ -	$ -	$ 26,400	$ -	$ 26,400	$ 65,000	$ 6,600	$ 65,000	$ -	$ -	$ -	$ -	$ 13,200	$ -	$ 13,200	$ -	$ 13,200	$ -	$ 19,800	$ -
Additional Unidentified Scope Items	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000
Sub-total	**$ 5,200**	**$ 9,000**	**$ 11,800**	**$ 9,000**	**$ 5,200**	**$ 9,000**	**$ 5,200**	**$ 9,000**	**$ 31,400**	**$ 11,800**	**$ 31,600**	**$ 74,000**	**$ 11,800**	**$ 74,000**	**$ 5,200**	**$ 9,000**	**$ 5,200**	**$ 9,000**	**$ 16,400**	**$ 9,000**	**$ 18,400**	**$ 9,000**	**$ 14,400**	**$ 9,000**	**$ 25,000**	**$ 9,000**
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 382,900	$ 258,600	$ 110,200	$ 130,175	$ 418,700	$ 322,025	$ 424,300	$ 152,750	$ 574,050	$ 132,625	$ 245,900	$ 461,125	$ 299,100	$ 252,000	$ 497,300	$ 222,500	$ 312,200	$ 147,800	$ 500,300	$ 135,991	$ 232,700	$ 139,413	$ 146,700	$ 161,538	$ 401,100	$ 217,750
Contingency (20%)	$ 72,580	$ 51,720	$ 22,040	$ 26,035	$ 83,340	$ 64,405	$ 84,860	$ 30,550	$ 114,810	$ 26,525	$ 49,180	$ 92,225	$ 59,820	$ 50,400	$ 99,460	$ 44,500	$ 62,440	$ 29,560	$ 100,060	$ 27,198	$ 46,540	$ 27,883	$ 29,340	$ 32,308	$ 80,220	$ 43,550
Engineering & Administration (20%)	$ 72,580	$ 51,720	$ 22,040	$ 26,035	$ 83,340	$ 64,405	$ 84,860	$ 30,550	$ 114,810	$ 26,525	$ 49,180	$ 92,225	$ 59,820	$ 50,400	$ 99,460	$ 44,500	$ 62,440	$ 29,560	$ 100,060	$ 27,198	$ 46,540	$ 27,883	$ 29,340	$ 32,308	$ 80,220	$ 43,550
Total Estimated Cost (Excluding PST & GST)	**$ 508,060**	**$ 362,040**	**$ 154,280**	**$ 182,245**	**$ 583,380**	**$ 450,835**	**$ 594,020**	**$ 213,850**	**$ 803,670**	**$ 185,675**	**$ 344,260**	**$ 645,575**	**$ 418,740**	**$ 352,800**	**$ 696,220**	**$ 311,500**	**$ 437,080**	**$ 206,920**	**$ 700,420**	**$ 190,387**	**$ 325,780**	**$ 195,178**	**$ 205,380**	**$ 226,153**	**$ 561,540**	**$ 304,850**
Grand Total = 10yr Total Cost + Future Costs (Excluding PST & GST)	**$870,100**		**$336,525**		**$1,034,215**		**$807,870**		**$989,345**		**$990,835**		**$771,540**		**$1,007,720**		**$644,000**		**$890,607**		**$529,958**		**$431,533**		**$866,390**	

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate
* Station was removed from scope of work (Not a typical Flood Pumping Station)

Table 5.1 - Summary Of Estimated 10 Year & Future Upgrade Costs

Item	B14 HAWTHORNE FPS		B15 JEFFERSON FPS		B16 JESSIE FPS		B17 * LARCHDALE SPS		B18 LAVERENDRYE FPS		B19 LINDEN FPS		B20 MAGER DRIVE FPS		B21 MARION FPS		B22 MAYFAIR FPS		B23 METCALFE FPS		B24 MISSION FPS		B25 * MUNROE FPS		B26 NEWTON FPS	
	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs
Building & Site																										
Replace membrane roofing, flashing and trim (including hatch)	$ -	$ -	$ 17,300	$ 17,300	$ 11,500	$ 11,500	$ -	$ -	$ 4,600	$ 4,600	$ -	$ -	$ -	$ -	$ -	$ 18,400	$ -	$ -	$ -	$ -	$ -	$ 20,700	$ -	$ -	$ -	$ -
Replace shingle roofing c/w new underlayment (including hatch)	$ -	$ -	$ -	$ -	$ -	$ 4,500	$ -	$ -	$ -	$ -	$ 5,800	$ 5,800	$ -	$ -	$ 8,100	$ -	$ -	$ -	$ -	$ 8,100	$ -	$ -	$ -	$ -	$ -	$ 12,700
Roof trim repair or upgrade (including drainage system)	$ -	$ -	$ 9,200	$ -	$ -	$ -	$ -	$ -	$ 2,900	$ -	$ 4,800	$ -	$ -	$ -	$ -	$ 3,450	$ 3,500	$ -	$ -	$ 4,100	$ -	$ 4,600	$ -	$ -	$ -	$ -
Install new sloped prefinished metal roof & trim over existing flat roof	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Localized wood frame wall repair	$ -	$ -	$ -	$ 5,750	$ -	$ -	$ -	$ -	$ -	$ 2,900	$ -	$ 2,900	$ -	$ 5,750	$ -	$ 5,750	$ -	$ -	$ -	$ 2,900	$ 6,900	$ 5,750	$ -	$ -	$ -	$ 2,900
Exterior siding and/or trim refinishing	$ -	$ -	$ 20,700	$ 27,600	$ 4,600	$ 18,400	$ -	$ -	$ 6,900	$ 13,800	$ -	$ 23,000	$ -	$ -	$ 2,300	$ 9,200	$ 3,500	$ -	$ 9,200	$ 18,400	$ 18,100	$ 36,800	$ -	$ -	$ -	$ 27,600
Exterior siding and/or trim repair or replace with similar material	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,700	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Major aesthetic upgrade (and/or major building repair or alterations)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 200,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 69,000	$ -
Installation of separate access to sanitary sewer chamber	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 46,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 46,000	$ -
Replace entry door and frame	$ -	$ -	$ -	$ 3,500	$ 3,500	$ 1,750	$ -	$ -	$ 3,500	$ 1,750	$ 3,500	$ 1,750	$ -	$ 1,750	$ -	$ 1,750	$ -	$ -	$ 3,500	$ 1,750	$ 3,500	$ 1,750	$ -	$ -	$ -	$ 1,750
Replace interior door and frame	$ -	$ -	$ -	$ -	$ -	$ 350	$ -	$ -	$ -	$ -	$ -	$ 350	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 350
Remove existing window and infill wall opening	$ -	$ -	$ 3,500	$ -	$ -	$ -	$ -	$ -	$ 2,900	$ -	$ 3,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,500	$ -	$ -	$ -	$ -	$ -
Create/rework wall openings for ventilation upgrades	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Minor brick repair and mortar joint repointing	$ -	$ -	$ -	$ -	$ -	$ 2,900	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,000	$ 2,900	$ 2,300	$ 5,750	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wall repair and installation of flashing at discharge block	$ -	$ -	$ -	$ -	$ 3,500	$ -	$ -	$ -	$ -	$ -	$ 7,000	$ -	$ -	$ 2,900	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,500	$ -	$ -	$ -	$ -	$ -
Sealant joint replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,900	$ 20,700	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Install thermal barrier over foamed plastic insulation in drywell	$ -	$ -	$ 20,700	$ -	$ 11,500	$ -	$ -	$ -	$ 5,800	$ -	$ 18,400	$ -	$ 11,500	$ -	$ 13,800	$ -	$ -	$ -	$ 6,900	$ -	$ 11,500	$ -	$ -	$ -	$ 13,800	$ -
Drywell stair safety upgrade (install intermediate rails on landings)	$ -	$ -	$ -	$ -	$ 2,300	$ -	$ -	$ -	$ -	$ -	$ 2,300	$ -	$ 2,300	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,300	$ -
Exterior stair safety upgrade (install handrails)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,300	$ -
Driveway and/or sidewalk repair or replacement	$ -	$ -	$ -	$ 4,600	$ -	$ 2,900	$ -	$ -	$ -	$ 2,900	$ -	$ 2,900	$ -	$ 17,250	$ -	$ 2,900	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Fencing repair, replacement or removal	$ -	$ -	$ -	$ 2,900	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,750	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Site regrading	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,300	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Unidentified Scope Items	$ -	$ -	$ 7,100	$ 6,150	$ 5,000	$ 5,000	$ -	$ -	$ 5,000	$ 5,000	$ 11,400	$ 5,000	$ 5,200	$ 5,000	$ 6,000	$ 6,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 6,950	$ -	$ -	$ 13,400	$ 5,000
Sub-total	**$ -**	**$ -**	**$ 78,500**	**$ 67,800**	**$ 41,900**	**$ 42,800**	**$ -**	**$ -**	**$ 31,600**	**$ 30,850**	**$ 129,200**	**$ 41,700**	**$ 219,000**	**$ 46,500**	**$ 25,400**	**$ 49,350**	**$ 21,200**	**$ 34,350**	**$ 26,900**	**$ 40,250**	**$ 50,000**	**$ 76,550**	**$ -**	**$ -**	**$ 146,800**	**$ 50,300**
Mechanical																										
Drywell Ventilation System Upgrades	$ -	$ -	$ 12,400	$ -	$ 10,000	$ -	$ -	$ -	$ 4,600	$ -	$ 9,500	$ -	$ 9,500	$ -	$ 10,000	$ -	$ -	$ -	$ 9,500	$ -	$ 9,500	$ -	$ -	$ -	$ 9,500	$ -
Main Floor Cooling Fan System Upgrades	$ -	$ -	$ 16,200	$ -	$ 13,900	$ -	$ -	$ -	$ 10,300	$ -	$ 11,800	$ -	$ 11,800	$ -	$ 13,900	$ -	$ -	$ -	$ 11,100	$ -	$ 12,500	$ -	$ -	$ -	$ 11,800	$ -
Convert Copper and Carbon Steel Shaft Seal Piping to PVC	$ -	$ -	$ 700	$ -	$ 1,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replace Existing Seal Water Valving	$ -	$ -	$ 1,700	$ 5,100	$ 1,300	$ 1,950	$ -	$ -	$ 1,000	$ 3,000	$ 1,200	$ 3,600	$ 1,200	$ 1,800	$ 1,300	$ 3,900	$ -	$ -	$ 1,200	$ 1,800	$ 1,400	$ 4,200	$ -	$ -	$ 1,200	$ 3,600
Replace flood pump pipe victaulic coupling and/or nuts & bolts	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 500	$ 750	$ 4,900	$ 3,675	$ -	$ -	$ 5,400	$ 4,050	$ -	$ -	$ 1,500	$ 2,250	$ 5,500	$ 4,125	$ -	$ -	$ 10,400	$ 7,050
Sandblast & Paint Pumps & Piping	$ -	$ -	$ 82,000	$ -	$ 33,000	$ -	$ -	$ -	$ 18,000	$ -	$ 22,700	$ -	$ 22,700	$ -	$ 33,000	$ -	$ -	$ -	$ 34,000	$ -	$ 33,000	$ -	$ -	$ -	$ 22,700	$ -
Bearing Cover Hardware Replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 300	$ -	$ 975	$ -	$ -	$ 700	$ 1,050	$ -	$ -	$ 400	$ 600	$ -	$ 1,050	$ -	$ -	$ -	$ 600
Paking Gland Cover Hardware Replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 450	$ -	$ -	$ 200	$ 300
Packing Gland Cover Replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Replace Copper Pipe on Shaft Seal Line at Tie- In Pump(s)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 300	$ -	$ -	$ -	$ 450	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 200
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point	$ -	$ -	$ -	$ -	$ -	$ 3,300	$ -	$ -	$ -	$ -	$ -	$ 3,300	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,300
Discharge Pipe Replacement	$ -	$ -	$ -	$ 6,750	$ -	$ 17,400	$ -	$ -	$ -	$ 1,350	$ -	$ -	$ -	$ 2,700	$ -	$ 4,050	$ -	$ 1,350	$ -	$ 2,700	$ -	$ 4,050	$ -	$ -	$ -	$ -
Replace Worn Shaft Bearing and Universal Joints	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500	$ -	$ 2,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Straighten or Replace Bent Shaft	$ -	$ -	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,500	$ -	$ 10,000	$ -	$ 2,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Assess Pump Bushing Clearances and Correct	$ -	$ -	$ 8,000	$ -	$ -	$ -	$ -	$ -	$ 2,000	$ -	$ -	$ -	$ -	$ 1,400	$ -	$ 2,000	$ -	$ 600	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Lower Shaft Bearing to Clear Shaft Coupling	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ -	$ 500	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Disassemble Shaft, Relieve Strain and Reinstall	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 500	$ -	$ 500	$ -	$ 250	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Align Misaligned Shaft	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 500	$ -	$ 500	$ -	$ 250	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	$ -	$ -	$ 1,000	$ 4,000	$ 800	$ 6,400	$ -	$ -	$ 800	$ 3,200	$ -	$ 2,800	$ 700	$ 2,800	$ 800	$ 3,200	$ -	$ 2,800	$ 800	$ 3,200	$ 800	$ 3,200	$ -	$ -	$ -	$ 2,800
Vibration Test and Thermal Scan	$ -	$ 2,600	$ -	$ 9,200	$ -	$ 9,200	$ -	$ -	$ -	$ 9,200	$ -	$ 9,200	$ 2,300	$ 9,200	$ 2,300	$ 9,200	$ 2,300	$ 9,200	$ -	$ 9,200	$ -	$ 9,200	$ -	$ -	$ -	$ 9,200
Additional Unidentified Scope Items	$ -	$ -	$ 15,000	$ 15,000	$ 10,000	$ 10,000	$ -	$ -	$ 5,000	$ 5,000	$ 7,500	$ 7,500	$ 7,500	$ 7,500	$ 10,000	$ 10,000	$ 5,000	$ 5,000	$ 7,500	$ 7,500	$ 10,000	$ 10,000	$ -	$ -	$ 7,500	$ 7,500
Sub-total	**$ -**	**$ 2,600**	**$ 187,000**	**$ 40,050**	**$ 70,600**	**$ 48,250**	**$ -**	**$ -**	**$ 47,200**	**$ 22,800**	**$ 57,400**	**$ 31,350**	**$ 55,700**	**$ 36,900**	**$ 77,400**	**$ 51,900**	**$ 7,300**	**$ 21,850**	**$ 70,000**	**$ 27,250**	**$ 72,700**	**$ 36,275**	**$ -**	**$ -**	**$ 63,300**	**$ 34,550**
Geotechnical																										
Visual inspection of riverbank outfall pipe	$ -	$ 16,000	$ 4,000	$ 16,000	$ 16,000	$ 16,000	$ -	$ -	$ -	$ 4,000	$ 4,000	$ 16,000	$ 4,000	$ 32,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ -	$ -	$ 4,000	$ 16,000
Install new inclinometers	$ -	$ -	$ -	$ -	$ -	$ 4,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Monitoring of inclinometers	$ -	$ -	$ -	$ -	$ 10,000	$ 16,000	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,000	$ -	$ 20,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Upgrade existing riprap blanket / install new riprap blanket	$ -	$ -	$ 23,900	$ -	$ -	$ 22,000	$ -	$ -	$ 37,000	$ -	$ -	$ 13,000	$ -	$ -	$ 76,000	$ -	$ -	$ 22,500	$ -	$ -	$ -	$ 11,000	$ -	$ -	$ 38,000	$ -
Drainage Improvements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Shear Key	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 250,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Unidentified Scope Items	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ -
Sub-total	**$ -**	**$ 16,000**	**$ 27,900**	**$ 16,000**	**$ 26,500**	**$ 54,000**	**$ -**	**$ -**	**$ 37,000**	**$ -**	**$ -**	**$ 13,000**	**$ -**	**$ 32,000**	**$ 350,000**	**$ 16,000**	**$ 4,000**	**$ 38,500**	**$ 4,000**	**$ 16,000**	**$ 4,000**	**$ 27,000**	**$ -**	**$ -**	**$ 47,000**	**$ 16,000**
Substructure & Gates																										
Repair grade beam cracks and/or spalling	$ -	$ -	$ 2,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,800	$ -	$ -	$ -	$ 3,900	$ -
Upgrade/repair drywell stairs/ladders/handrails/hatches	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 200	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,700	$ -
Inject & patch cracks in dry well concrete walls and or beams	$ -	$ -	$ 20,900	$ -	$ -	$ 9,650	$ -	$ -	$ 13,800	$ -	$ 10,800	$ -	$ 15,400	$ -	$ 15,700	$ -	$ -	$ -	$ 10,700	$ -	$ 10,700	$ -	$ -	$ -	$ 13,200	$ -
Repair drywell floor/swale with new sloped concrete topping	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6,000	$ -	$ 10,700	$ -	$ 16,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 12,700	$ -	$ -	$ -	$ -	$ -
Repair spalled pump base concrete, grout and/or anchor bolts	$ -	$ -	$ 2,200	$ -	$ 4,400	$ -	$ -	$ -	$ 4,400	$ -	$ 2,200	$ -	$ 4,400	$ -	$ 4,400	$ -	$ -	$ -	$ 3,300	$ -	$ -	$ -	$ -	$ -	$ 4,400	$ -
Discharge box concrete repairs	$ -	$ -	$ -	$ 2,350	$ -	$ 1,650	$ -	$ -	$ 2,100	$ -	$ 6,500	$ -	$ 3,700	$ -	$ 5,300	$ -	$ -	$ -	$ 4,600	$ -	$ 6,100	$ -	$ -	$ -	$ 6,100	$ -
Discharge stoplog and guide repairs	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Add vents to discharge box to reduce condensation	$ -	$ -	$ 2,200	$ -	$ -	$ -	$ -	$ -	$ 2,200	$ -	$ 2,200	$ -	$ 2,200	$ -	$ -	$ -	$ -	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ 2,200	$ -
Replace/Repair flap gate, frame, anchor bolts and/or thimble	$ -	$ -	$ -	$ 30,675	$ -	$ 34,300	$ -	$ -	$ -	$ 2,250	$ -	$ 27,000	$ -	$ 17,700	$ -	$ 33,000	$ -	$ 5,775	$ -	$ 7,325	$ -	$ 33,075	$ -	$ -	$ -	$ 39,000
Replace/Repair side gate, frame, anchor bolts and/or thimble	$ 32,100	$ -	$ -	$ 40,875	$ -	$ 94,500	$ -	$ -	$ -	$ 3,125	$ 72,500	$ -	$ -	$ 21,650	$ -	$ 49,500	$ -	$ 16,050	$ -	$ 7,775	$ 5,500	$ 50,750	$ -	$ -	$ 12,500	$ 37,650
Install new access platforms for pump shaft guide bearings	$ -	$ -	$ 16,100	$ -	$ 19,100	$ -	$ -	$ -	$ 16,000	$ -	$ 8,000	$ -	$ 8,000	$ -	$ 8,300	$ -	$ -	$ 11,000	$ -	$ -	$ 11,000	$ -	$ -	$ -	$ 8,900	$ -
Gate chamber concrete repairs	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,900	$ -	$ -	$ -	$ -	$ -	$ 3,900	$ -	$ -	$ -	$ 11,000	$ -	$ -	$ -	$ -	$ -
Repair wetwell roof, wall and column concrete (cracks and or spalling)	$ -	$ -	$ 1,500	$ -	$ 1,500	$ -	$ -	$ -	$ 1,500	$ -	$ 6,900	$ -	$ 3,000	$ -	$ -	$ 4,500	$ 3,000	$ -	$ 1,500	$ -	$ 4,500	$ -	$ -	$ -	$ 3,000	$ -
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)	$ -	$ -	$ -	$ 2,250	$ -	$ 2,250	$ -	$ -	$ -	$ 2,250	$ -	$ 2,250	$ -	$ 2,250	$ 3,000	$ -	$ -	$ 2,250	$ -	$ 2,250	$ 1,500	$ -	$ -	$ -	$ -	$ -
Inspect & upgrade/repair wetwell trashracks	$ -	$ -	$ 2,500	$ 7,500	$ 2,500	$ 7,500	$ -	$ -	$ 1,500	$ 3,750	$ 1,500	$ -	$ 1,500	$ -	$ 7,500	$ -	$ -	$ -	$ 1,500	$ -	$ 7,500	$ -	$ -	$ -	$ -	$ -
Upgrade/repair wetwell ladders and railings	$ -	$ -	$ 5,500	$ -	$ 1,000	$ -	$ -	$ -	$ 3,750	$ -	$ 3,750	$ -	$ 3,750	$ -	$ 5,000	$ -	$ 500	$ -	$ 2,500	$ 1,875	$ 5,000	$ -	$ -	$ -	$ 1,000	$ -
Upgrade/repair wetwell slide gate shafts and shaft supports	$ -	$ -	$ -	$ -	$ 50,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Clean wetwell floor	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Additional Unidentified Scope Items	$ 6,900	$ -	$ 5,000	$ 7,400	$ 8,000	$ 5,000	$ -	$ -	$ 5,000	$ 5,000	$ 11,300	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 9,000	$ 5,000	$ 5,000	$ 5,000	$ 5,000	$ 6,000	$ 9,400	$ -	$ -	$ 5,300	$ 8,900
Sub-total	**$ 42,700**	**$ -**	**$ 58,400**	**$ 91,050**	**$ 86,500**	**$ 154,850**	**$ -**	**$ -**	**$ 57,550**	**$ 16,375**	**$ 145,250**	**$ 34,250**	**$ 56,950**	**$ 46,600**	**$ 55,400**	**$ 96,000**	**$ 13,900**	**$ 29,075**	**$ 40,600**	**$ 24,225**	**$ 84,300**	**$ 103,225**	**$ -**	**$ -**	**$ 62,200**	**$ 85,550**
Electrical																										
Upgrade exterior lighting	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ -	$ -	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ -	$ 1,800	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ -	$ -	$ 2,200	$ 2,200
Upgrade interior lighting	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ -	$ -	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ -	$ 2,200	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ -	$ -	$ 1,800	$ 1,800
Service entrance upgrade	$ -	$ -	$ 32,900	$ -	$ -	$ -	$ -	$ -	$ 13,200	$ -	$ 13,200	$ -	$ 19,800	$ -	$ -	$ -	$ -	$ -	$ 13,200	$ -	$ 19,800	$ -	$ -	$ -	$ 13,200	$ -
Additional Unidentified Scope Items	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ -	$ -	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ -	$ -	$ 1,200	$ 5,000
Sub-total	**$ 5,200**	**$ 9,000**	**$ 38,100**	**$ 9,000**	**$ 5,200**	**$ 9,000**	**$ -**	**$ -**	**$ 5,200**	**$ 9,000**	**$ 18,400**	**$ 9,000**	**$ 18,400**	**$ 9,000**	**$ 25,000**	**$ 9,000**	**$ 1,200**	**$ 9,000**	**$ 18,400**	**$ 9,000**	**$ 25,000**	**$ 9,000**	**$ -**	**$ -**	**$ 18,400**	**$ 9,000**
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 47,900**	**$ 27,600**	**$ 389,000**	**$ 223,900**	**$ 228,700**	**$ 308,900**	**$ -**	**$ -**	**$ 145,550**	**$ 132,125**	**$ 354,250**	**$ 145,300**	**$ 364,050**	**$ 171,000**	**$ 535,200**	**$ 222,250**	**$ 47,600**	**$ 132,675**	**$ 158,900**	**$ 116,725**	**$ 235,000**	**$ 252,050**	**$ -**	**$ -**	**$ 337,700**	**$ 195,400**
Contingency (20%)	$ 9,580	$ 5,520	$ 77,800	$ 44,780	$ 45,740	$ 61,780	$ -	$ -	$ 29,110	$ 26,425	$ 70,850	$ 29,060	$ 72,810	$ 34,200	$ 107,040	$ 44,450	$ 9,520	$ 26,575	$ 31,980	$ 23,345	$ 47,200	$ 50,410	$ -	$ -	$ 67,540	$ 39,080
Engineering & Administration (20%)	$ 9,580	$ 5,520	$ 77,800	$ 44,780	$ 45,740	$ 61,780	$ -	$ -	$ 29,110	$ 26,425	$ 70,850	$ 29,060	$ 72,810	$ 34,200	$ 107,040	$ 44,450	$ 9,520	$ 26,575	$ 31,980	$ 23,345	$ 47,200	$ 50,410	$ -	$ -	$ 67,540	$ 39,080
Total Estimated Cost (Excluding PST & GST)	**$ 67,060**	**$ 38,640**	**$ 544,600**	**$ 313,460**	**$ 320,180**	**$ 432,460**	**$ -**	**$ -**	**$ 203,770**	**$ 184,975**	**$ 495,950**	**$ 203,420**	**$ 509,670**	**$ 239,400**	**$ 749,280**	**$ 311,150**	**$ 66,640**	**$ 185,825**	**$ 223,860**	**$ 163,415**	**$ 330,400**	**$ 352,870**	**$ -**	**$ -**	**$ 472,780**	**$ 273,560**

Grand Total = 10yr Total Cost + Future Costs (Excluding PST & GST)	B14	B15	B16	B17 *	B18	B19	B20	B21	B22	B23	B24	B25 *	B26
	$105,700	$858,060	$752,640	$0	$388,745	$699,370	$749,070	$1,080,430	$252,665	$387,275	$883,270	$0	$746,340

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate
* Station was removed from scope of work (Not a typical Flood Pumping Station)

Table 5.1 - Summary Of Estimated 10 Year & Future Upgrade Costs

Item	B27 POLSON FPS		B28 ROLAND FPS		B29 SELKIRK FPS		B30 ST. JOHN'S FPS		B31 SYNDICATE FPS		B32 * RAVELSTON LDPS		SUMMARY	
	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs	10 Year Total Cost	Future Costs
Building & Site														
Replace membrane roofing, flashing and trim (including hatch)	$ -	$ -	$ 33,400	$ -	$ 11,500	$ 11,500	$ 12,700	$ 12,700	$ -	$ -	$ -	$ -	$ 153,900	$ 233,000
Replace shingle roofing c/w new underlayment (including hatch)	$ -	$ 13,800	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,500	$ -	$ -	$ -	$ 5,900	$ 48,500
Roof trim repair or upgrade (including drainage system)	$ -	$ -	$ 2,300	$ -	$ -	$ -	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ 42,400	$ 17,600
Install new sloped prefinished metal roof & trim over existing flat roof	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 34,500	$ -	$ -	$ -	$ 34,500	$ -
Localized wood frame wall repair	$ -	$ 2,900	$ -	$ -	$ -	$ 2,900	$ 6,000	$ 2,900	$ -	$ 2,900	$ -	$ -	$ 12,900	$ 50,700
Exterior siding and/or trim refinishing	$ -	$ 27,600	$ 3,500	$ 13,800	$ -	$ 27,600	$ 16,100	$ 27,600	$ -	$ 9,200	$ -	$ -	$ 122,100	$ 449,100
Exterior siding and/or trim repair or replace with similar material	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,700	$ 1,750
Major aesthetic upgrade (and/or major building repair or alterations)	$ 69,000	$ -	$ -	$ -	$ 80,500	$ -	$ -	$ -	$ 46,000	$ -	$ -	$ -	$ 1,062,500	$ -
Installation of separate access to sanitary sewer chamber	$ 46,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 230,000	$ -
Replace entry door and frame	$ -	$ 1,750	$ 3,500	$ 1,750	$ -	$ 1,750	$ 3,500	$ 1,750	$ -	$ 2,625	$ -	$ -	$ 38,500	$ 52,775
Replace interior door and frame	$ -	$ 350	$ -	$ 350	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 4,900
Remove existing window and infill wall opening	$ -	$ -	$ -	$ -	$ -	$ -	$ 3,500	$ -	$ -	$ -	$ -	$ -	$ 18,600	$ -
Create/rework wall openings for ventilation upgrades	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Minor brick repair and mortar joint repointing	$ -	$ -	$ 3,500	$ 2,900	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,000	$ 40,000
Wall repair and installation of flashing at discharge block	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 21,000	$ 2,900
Sealant joint replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10,300	$ 20,700
Install thermal barrier over foamed plastic insulation in drywell	$ 13,800	$ -	$ 11,500	$ -	$ 13,800	$ -	$ 11,500	$ -	$ 9,200	$ -	$ -	$ -	$ 333,800	$ -
Drywell stair safety upgrade (install intermediate rails on landings)	$ -	$ -	$ -	$ -	$ 4,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 27,700	$ -
Exterior stair safety upgrade (install handrails)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,800	$ -
Driveway and/or sidewalk repair or replacement	$ -	$ 5,800	$ -	$ -	$ -	$ -	$ -	$ 4,350	$ -	$ 2,900	$ -	$ -	$ 13,500	$ 81,150
Fencing repair, replacement or removal	$ -	$ 2,300	$ -	$ -	$ -	$ 5,750	$ -	$ -	$ -	$ -	$ -	$ -	$ 7,000	$ 21,350
Site regrading	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 24,000	$ 1,750
Additional Unidentified Scope Items	$ 12,900	$ 5,450	$ 5,000	$ 5,000	$ 11,000	$ 5,000	$ 5,800	$ 5,000	$ 9,000	$ 5,000	$ -	$ -	$ 232,300	$ 145,150
Sub-total	**$ 141,700**	**$ 59,950**	**$ 62,700**	**$ 23,800**	**$ 121,400**	**$ 54,500**	**$ 63,700**	**$ 54,300**	**$ 98,700**	**$ 22,625**	**$ -**	**$ -**	**$ 2,448,800**	**$ 1,181,325**
Mechanical														
Drywell Ventilation System Upgrades	$ 9,500	$ -	$ 10,000	$ -	$ 9,700	$ -	$ 10,000	$ -	$ 6,900	$ -	$ -	$ -	$ 249,000	$ -
Main Floor Cooling Fan System Upgrades	$ -	$ -	$ 11,800	$ -	$ 13,900	$ -	$ 13,900	$ -	$ 10,300	$ -	$ -	$ -	$ 299,900	$ -
Convert Copper and Carbon Steel Shaft Seal Piping to PVC	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 8,900	$ -
Replace Existing Seal Water Valving	$ 1,400	$ 2,100	$ 1,200	$ 1,800	$ 1,500	$ 4,500	$ 1,900	$ 4,800	$ 1,200	$ 1,800	$ -	$ -	$ 30,600	$ 72,300
Replace flood pump pipe victaulic coupling and/or nuts & bolts	$ -	$ -	$ -	$ -	$ -	$ -	$ 500	$ 375	$ -	$ -	$ -	$ -	$ 55,900	$ 42,075
Sandblast & Paint Pumps & Piping	$ 50,000	$ -	$ 22,700	$ -	$ 66,000	$ -	$ 66,000	$ -	$ 34,000	$ -	$ -	$ -	$ 994,700	$ -
Bearing Cover Hardware Replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,500	$ 8,156
Packing Gland Cover Hardware Replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 600	$ 2,700
Packing Gland Cover Replacement	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,800
Replace Copper Pipe on Shaft Seal Line at Tie- In Pump(s)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,350
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point	$ -	$ -	$ -	$ -	$ -	$ 3,300	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 19,800
Discharge Pipe Replacement	$ -	$ 4,050	$ -	$ 2,700	$ -	$ 5,400	$ -	$ 5,400	$ -	$ 2,700	$ -	$ -	$ -	$ 107,850
Replace Worm Shaft Bearing and Universal Joints	$ -	$ 2,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 25,000	$ 23,750
Straighten or Replace Bent Shaft	$ -	$ 10,000	$ -	$ -	$ -	$ -	$ 25,000	$ -	$ -	$ -	$ -	$ -	$ 100,000	$ 95,000
Assess Pump Bushing Clearances and Correct	$ -	$ 2,000	$ -	$ -	$ -	$ -	$ 4,000	$ -	$ -	$ -	$ -	$ -	$ 20,000	$ 19,200
Lower Shaft Bearing to Clear Shaft Coupling	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ 4,750
Disassemble Shaft, Relieve Strain and Reinstall	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ 5,000
Align Misaligned Shaft	$ -	$ 500	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ -	$ -	$ -	$ 5,000	$ 5,000
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	$ 900	$ 2,600	$ 700	$ 2,800	$ 900	$ 3,600	$ 900	$ 3,600	$ 800	$ 3,200	$ -	$ -	$ 21,100	$ 97,800
Vibration Test and Thermal Scan	$ 2,300	$ 9,200	$ -	$ 9,200	$ -	$ 9,200	$ -	$ 9,200	$ -	$ 9,200	$ -	$ -	$ 25,300	$ 260,200
Additional Unidentified Scope Items	$ 10,000	$ 10,000	$ 7,500	$ 7,500	$ 12,500	$ 12,500	$ 12,500	$ 12,500	$ 7,500	$ 7,500	$ -	$ -	$ -	$ -
Sub-total	**$ 74,100**	**$ 43,950**	**$ 53,900**	**$ 24,000**	**$ 104,500**	**$ 38,500**	**$ 134,400**	**$ 35,875**	**$ 65,700**	**$ 24,400**	**$ -**	**$ -**	**$ 2,108,500**	**$ 1,026,741**
Geotechnical														
Visual inspection of riverbank outfall pipe	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ 4,000	$ 16,000	$ -	$ -	$ 116,000	$ 460,000
Install new inclinometers	$ -	$ -	$ 4,500	$ -	$ -	$ -	$ -	$ -	$ 4,500	$ -	$ -	$ -	$ 21,000	$ -
Monitoring of inclinometers	$ -	$ -	$ 10,000	$ -	$ 20,000	$ -	$ 20,000	$ -	$ 10,000	$ -	$ -	$ -	$ 179,500	$ 16,000
Upgrade existing riprap blanket / install new riprap blanket	$ 29,000	$ -	$ -	$ 60,000	$ 78,000	$ -	$ 78,000	$ -	$ 30,500	$ -	$ -	$ -	$ 703,500	$ 312,250
Drainage Improvements	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ -
Shear Key	$ -	$ -	$ -	$ 125,000	$ 250,000	$ -	$ 250,000	$ -	$ -	$ -	$ -	$ -	$ 1,250,000	$ 125,000
Additional Unidentified Scope Items	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 5,000	$ 26,000
Sub-total	**$ 33,000**	**$ 16,000**	**$ 18,500**	**$ 201,000**	**$ 352,000**	**$ 16,000**	**$ 352,000**	**$ 16,000**	**$ 49,000**	**$ 16,000**	**$ -**	**$ -**	**$ 2,282,000**	**$ 939,250**
Substructure & Gates														
Repair grade beam cracks and/or spalling	$ 2,800	$ -	$ -	$ -	$ 2,800	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 23,500	$ 27,500
Upgrade/repair drywell stairs/ladders/handrails/hatches	$ 1,700	$ -	$ -	$ -	$ -	$ -	$ 1,700	$ -	$ -	$ -	$ -	$ -	$ 7,000	$ -
Inject & patch cracks in dry well concrete walls and or beams	$ 13,100	$ -	$ 17,700	$ -	$ 12,000	$ -	$ 14,900	$ -	$ -	$ 2,850	$ -	$ -	$ 285,100	$ 37,750
Repair drywell floor/swale with new sloped concrete topping	$ 19,200	$ -	$ -	$ -	$ -	$ -	$ 13,000	$ -	$ -	$ -	$ -	$ -	$ 101,500	$ -
Repair spalled pump base concrete, grout and/or anchor bolts	$ 4,400	$ -	$ 4,400	$ -	$ 6,600	$ -	$ 6,600	$ -	$ 2,200	$ -	$ -	$ -	$ 72,600	$ -
Discharge box concrete repairs	$ 6,700	$ -	$ -	$ -	$ 7,300	$ -	$ 9,000	$ -	$ 3,300	$ -	$ -	$ -	$ 99,200	$ 15,325
Discharge stoplog and guide repairs	$ 11,000	$ -	$ -	$ -	$ 11,000	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 33,000	$ -
Add vents to discharge box to reduce condensation	$ 2,200	$ -	$ 2,200	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 31,300	$ -
Replace/Repair flap gate, frame, anchor bolts and/or thimble	$ -	$ 32,625	$ -	$ 48,300	$ -	$ 28,050	$ -	$ 92,025	$ -	$ 13,275	$ -	$ -	$ 44,300	$ 715,238
Replace/Repair slide gate, frame, anchor bolts and/or thimble	$ -	$ 54,000	$ 89,900	$ -	$ 50,600	$ -	$ -	$ 153,650	$ -	$ 18,450	$ -	$ -	$ 553,100	$ 817,113
Install new access platforms for pump shaft guide bearings	$ -	$ -	$ 25,900	$ -	$ 9,600	$ -	$ 9,200	$ -	$ -	$ -	$ -	$ -	$ 306,300	$ -
Gate chamber concrete repairs	$ 6,600	$ -	$ -	$ -	$ 6,600	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 173,100	$ -
Repair wetwell roof, wall and column concrete (cracks and or spalling)	$ 6,000	$ -	$ 1,500	$ -	$ 4,500	$ -	$ 7,500	$ -	$ -	$ -	$ -	$ -		
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)	$ -	$ 2,250	$ -	$ 2,250	$ -	$ 2,250	$ -	$ 2,250	$ -	$ -	$ -	$ -		
Inspect & upgrade/repair wetwell trashracks	$ 2,000	$ 5,625	$ -	$ 7,500	$ 1,500	$ 3,750	$ 1,500	$ 3,750	$ 1,500	$ -	$ -	$ -		
Upgrade/repair wetwell ladders and railings	$ 4,000	$ -	$ -	$ 1,875	$ 3,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
Upgrade/repair wetwell slide gate shafts and shaft supports	$ -	$ -	$ -	$ 37,500	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
Clean wetwell floor	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -		
Additional Unidentified Scope Items	$ 7,500	$ 10,000	$ 10,000	$ 5,000	$ 9,000	$ 5,000	$ 5,000	$ 7,900	$ 5,000	$ 5,000	$ -	$ -	$ 196,900	$ 184,000
Sub-total	**$ 76,200**	**$ 104,500**	**$ 149,800**	**$ 102,425**	**$ 123,600**	**$ 39,050**	**$ 84,400**	**$ 238,675**	**$ 12,000**	**$ 39,575**	**$ -**	**$ -**	**$ 2,316,200**	**$ 2,317,425**
Electrical														
Upgrade exterior lighting	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ 2,200	$ -	$ -	$ 59,200	$ 66,200
Upgrade interior lighting	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ 1,800	$ -	$ -	$ 48,600	$ 52,800
Service entrance upgrade	$ 19,800	$ -	$ -	$ -	$ 26,400	$ -	$ 19,800	$ -	$ 13,200	$ -	$ -	$ -	$ 329,900	$ 130,000
Additional Unidentified Scope Items	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ 1,200	$ 5,000	$ -	$ -	$ 34,800	$ 145,000
Sub-total	**$ 25,000**	**$ 9,000**	**$ 5,200**	**$ 9,000**	**$ 31,600**	**$ 9,000**	**$ 25,000**	**$ 9,000**	**$ 18,400**	**$ 9,000**	**$ -**	**$ -**	**$ 472,500**	**$ 393,800**
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 352,000**	**$ 233,400**	**$ 290,100**	**$ 360,225**	**$ 733,300**	**$ 157,050**	**$ 639,500**	**$ 353,850**	**$ 243,800**	**$ 111,600**	**$ -**	**$ -**	**$ 9,628,000**	**$ 5,878,541**
Contingency (20%)	$ 70,400	$ 46,680	$ 58,020	$ 72,045	$ 146,660	$ 31,410	$ 127,900	$ 70,770	$ 48,760	$ 22,320	$ -	$ -	$ 1,925,600	$ 1,175,708
Engineering & Administration (20%)	$ 70,400	$ 46,680	$ 58,020	$ 72,045	$ 146,660	$ 31,410	$ 127,900	$ 70,770	$ 48,760	$ 22,320	$ -	$ -	$ 1,925,600	$ 1,175,708
Total Estimated Cost (Excluding PST & GST)	**$ 492,800**	**$ 326,760**	**$ 406,140**	**$ 504,315**	**$ 1,026,620**	**$ 219,870**	**$ 895,300**	**$ 495,390**	**$ 341,320**	**$ 156,240**	**$ -**	**$ -**	**$ 13,479,200**	**$ 8,229,957**
Grand Total = 10yr Total Cost + Future Costs (Excluding PST & GST)	**$819,560**		**$910,455**		**$1,246,490**		**$1,390,690**		**$497,560**		**$0**		**$21,709,157**	

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

* Station was removed from scope of work (Not a typical Flood Pumping Station)

Table B1.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	medium	$ 5,800		$ 5,800	$ 25,300	100%	$ 25,300	Hydro roof (plus 1 future total replacement)
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)	medium	$ 1,400		$ 1,400	$ 1,400	100%	$ 1,400	Rain gutter & Hydro enclosure drain repair
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing	medium	$ 3,500		$ 3,500	$ 13,800	100%	$ 13,800	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -	$ 3,500	50%	$ 1,750	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	25%	$ 350	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing	medium	$ 4,600		$ 4,600	$ 5,800	50%	$ 2,900	Hydro enclosure wall repair
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800		$ 13,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement	low		$ 3,500	$ 3,500	$ 5,800	50%	$ 2,900	
Fencing repair, replacement or removal	low		$ 3,500	$ 3,500	$ 3,500	50%	$ 1,750	
Site regrading	low		$ 3,500	$ 3,500	$ 3,500	50%	$ 1,750	
Additional Unidentified Scope Items				$ 5,000			$ 5,400	
Sub-total		**$ 29,100**	**$ 10,500**	**$ 44,600**	**$ 67,500**		**$ 59,050**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 10,500		$ 10,500			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 16,200		$ 16,200			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC	high	$ 1,700		$ 1,700			$ -	One Time Only
Replace Existing Seal Water Valving	high	$ 1,200		$ 1,200	$ 4,800	75%	$ 3,600	Every 10 years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	high	$ 43,300		$ 43,300			$ -	One Time Only
Bearing Cover Hardware Replacement	medium		$ 900	$ 900	$ 1,800	75%	$ 1,350	Every 20 years
Packing Gland Cover Hardware Replacement	medium		$ 400	$ 400	$ 800	75%	$ 600	Every 20 years
Packing Gland Cover Replacement				$ -	$ 2,400	75%	$ 1,800	Every 20 years
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -	$ 800	50%	$ 400	Every 20 years
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	60%	$ 5,400	
Replace Worn Shaft Bearing and/or Universal Joints				$ -	$ 25,000	10%	$ 2,500	
Straighten or Replace Bent Shaft				$ -	$ 25,000	50%	$ 12,500	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	130%	$ 2,600	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000	10%	$ 500	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	10%	$ 500	
Align Misaligned Shaft				$ -	$ 5,000	10%	$ 500	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 900		$ 900	$ 3,600	100%	$ 3,600	Every 10 years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 years
Additional Unidentified Scope Items				$ 12,500	$ 12,500	100%	$ 12,500	
Sub-total		**$ 76,100**	**$ 1,300**	**$ 89,900**	**$ 111,900**		**$ 57,550**	

Table B1.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers	medium	$ 2,500		$ 2,500			$ -	One required in total
Monitoring of inclinometers	medium	$ 5,000	$ 5,000	$ 10,000			$ -	
Upgrde existing riprap blanket/install new riprap blanket	medium		$ 79,000	$ 79,000			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		**$ 9,500**	**$ 86,000**	**$ 95,500**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 16,000	$ 16,000			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs				$ -			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 91,000	25%	$ 22,750	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	medium	$ 74,800		$ 74,800			$ -	Anchor bolts repaired
Install new access platforms for pump shaft guide bearings	medium	$ 19,200		$ 19,200			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -	$ 6,000	75%	$ 4,500	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 2,500		$ 2,500	$ 10,000	75%	$ 7,500	
Upgrade/repair wetwell ladders and railings	high	$ 2,500		$ 2,500			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -	$ 100,000	75%	$ 75,000	
Clean wetwell floor	medium	$ 2,500		$ 2,500			$ -	
Additional Unidentified Scope Items				$ 8,000			$ 5,000	
Sub-total		**$ 103,700**	**$ 16,000**	**$ 127,700**	**$ 210,000**		**$ 117,000**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	Implement with exterior upgrades
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade				$ -				
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 4,000**	**$ -**	**$ 5,200**	**$ 9,000**		**$ 9,000**	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 362,900**	**$ 258,600**	**$ 621,500**
Contingency (20%)	$ 72,580	$ 51,720	$ 124,300
Engineering & Administration (20%)	$ 72,580	$ 51,720	$ 124,300
Total Estimated Cost (Excluding PST & GST)	**$ 508,060**	**$ 362,040**	**$ 870,100**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B2.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -	$ 9,200	100%	$ 9,200	2 future replacements
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -	$ 2,300	50%	$ 1,150	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing	low		$ 1,700	$ 1,700	$ 5,200	100%	$ 5,200	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -	$ 2,300	50%	$ 1,150	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 8,100		$ 8,100			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 8,100**	**$ 1,700**	**$ 14,800**	**$ 28,300**		**$ 26,350**	

Mechanical								
Drywell Ventilation System Upgrades	medium	$ 6,900		$ 6,900			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 10,900		$ 10,900			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	medium		$ 1,000	$ 1,000	$ 2,000	75%	$ 1,500	Every 20 years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	medium	$ 18,000		$ 18,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	15%	$ 1,350	
Replace Worn Shaft Bearing and/or Universal Joints				$ -	$ 25,000	5%	$ 1,250	
Straighten or Replace Bent Shaft				$ -	$ 25,000	10%	$ 2,500	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	30%	$ 600	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000	5%	$ 250	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	5%	$ 250	
Align Misaligned Shaft				$ -	$ 5,000	5%	$ 250	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 10 years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 years
Additional Unidentified Scope Items				$ 5,000	$ 5,000	100%	$ 5,000	
Sub-total		**$ 38,900**	**$ 1,000**	**$ 44,900**	**$ 95,400**		**$ 25,350**	

Table B2.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers							$ -	
Monitoring of inclinometers							$ -	
Upgrade existing riprap blanket/install new riprap blanket					$ 28,000	100%	$ 28,000	
Drainage Improvements	low		$ 5,000	$ 5,000			$ -	
Shear Key							$ -	
Additional Unidentified Scope Items							$ -	
Sub-total		$ 2,000	$ 7,000	$ 9,000	$ 44,000		$ 44,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches	high	$ 600		$ 600			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 5,900	$ 5,900			$ -	
Repair drywell floor/swale with new sloped concrete topping	low		$ 4,300	$ 4,300			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 2,200		$ 2,200			$ -	
Discharge box concrete repairs	medium	$ 2,000		$ 2,000			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 33,750	25%	$ 8,438	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 39,150	25%	$ 9,788	
Install new access platforms for pump shaft guide bearings				$ -			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 2,250	$ 2,250			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks				$ -			$ -	
Upgrade/repair wetwell ladders and railings	high	$ 3,750		$ 3,750			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor	medium	$ 1,500		$ 1,500			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		$ 12,250	$ 12,450	$ 29,700	$ 75,900		$ 25,475	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	Implement with exterior upgrades
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 6,600		$ 6,600			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 10,600	$ -	$ 11,800	$ 9,000		$ 9,000	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 110,200	$ 130,175	$ 240,375
Contingency (20%)	$ 22,040	$ 26,035	$ 48,075
Engineering & Administration (20%)	$ 22,040	$ 26,035	$ 48,075
Total Estimated Cost (Excluding PST & GST)	$ 154,280	$ 182,245	$ 336,525

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B3.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	medium	$ 14,400		$ 14,400	$ 19,000	100%	$ 19,000	future includes Hydro area
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)	medium	$ 3,500		$ 3,500			$ -	remove overhang at time of roof replacement
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing	low		$ 1,700	$ 1,700	$ 6,900	100%	$ 6,900	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame	medium	$ 3,500		$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	25%	$ 350	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing	low		$ 2,300	$ 2,300	$ 5,800	50%	$ 2,900	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800		$ 13,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 17,300	50%	$ 8,650	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 35,200**	**$ 4,000**	**$ 44,200**	**$ 53,900**		**$ 44,550**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 10,000		$ 10,000			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 16,200		$ 16,200			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC	medium		$ 1,700	$ 1,700			$ -	One Time Only
Replace Existing Seal Water Valving	high	$ 1,400		$ 1,400	$ 5,600	75%	$ 4,200	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	medium		$ 9,000	$ 9,000	$ 9,000	75%	$ 6,750	Every 30 Years
Sandblast & Paint Pumps & Piping	medium	$ 43,300		$ 43,300			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	60%	$ 5,400	
Replace Worn Shaft Bearing and/or Universal Joints				$ -	$ 25,000	10%	$ 2,500	
Straighten or Replace Bent Shaft				$ -	$ 25,000	50%	$ 12,500	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	130%	$ 2,600	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000	10%	$ 500	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	10%	$ 500	
Align Misaligned Shaft				$ -	$ 5,000	10%	$ 500	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 900		$ 900	$ 3,600	100%	$ 3,600	Every 10 Years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 12,500	$ 12,500	100%	$ 12,500	
Sub-total		**$ 74,100**	**$ 10,700**	**$ 97,300**	**$ 115,900**		**$ 60,750**	

Table B3.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	One required in total
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket	medium		$ 52,000	$ 52,000			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 2,000**	**$ 54,000**	**$ 56,000**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling	low		$ 2,800	$ 2,800	$ 55,000	50%	$ 27,500	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams				$ -	$ 16,600	50%	$ 8,300	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs				$ -	$ 6,150	50%	$ 3,075	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble	very high	$ 36,000		$ 36,000			$ -	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	very high	$ 18,000		$ 18,000	$ 72,400	75%	$ 54,300	Anchor bolts sheared
Install new access platforms for pump shaft guide bearings	medium	$ 21,800		$ 21,800			$ -	
Gate chamber concrete repairs	medium	$ 110,000		$ 110,000			$ -	Replace section of gate chamber
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -	$ 6,000	75%	$ 4,500	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 2,500		$ 2,500	$ 10,000	75%	$ 7,500	
Upgrade/repair wetwell ladders and railings	high	$ 2,500		$ 2,500			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -	$ 100,000	75%	$ 75,000	
Clean wetwell floor	medium	$ 1,500		$ 1,500			$ -	
Additional Unidentified Scope Items				$ 18,900			$ 9,300	
Sub-total		**$ 192,300**	**$ 2,800**	**$ 214,000**	**$ 269,150**		**$ 191,725**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	Implement with exterior upgrades
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade				$ -			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 4,000**	**$ -**	**$ 5,200**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 416,700**		**$ 322,025**	**$ 738,725**
Contingency (20%)	$ 83,340		$ 64,405	$ 147,745
Engineering & Administration (20%)	$ 83,340		$ 64,405	$ 147,745
Total Estimated Cost (Excluding PST & GST)	**$ 583,380**		**$ 450,835**	**$ 1,034,215**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B4.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -	$ 11,500	100%	$ 11,500	
Replace shingle roofing c/w new underlayment (including hatch)				$ -				
Roof trim repair or upgrade (including drainage system)				$ -		100%	$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -		50%	$ -	
Exterior siding and/or trim refinishing				$ -	$ 23,000	100%	$ 23,000	Every 10 years
Exterior siding ~~and/or trim repair or replace with similar material~~				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)	medium	$ 138,000		$ 138,000			$ -	aesthetic upgrade
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame	low		$ 3,500	$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening	low		$ 1,700	$ 1,700			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 10,400		$ 10,400			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)	medium	$ 1,200		$ 1,200			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal	medium	$ 3,500		$ 3,500			$ -	fence removal
Site regrading	medium	$ 3,500	$ 4,600	$ 8,100			$ -	install swale on north side - drain to east
Additional Unidentified Scope Items				$ 16,600			$ 5,000	
Sub-total		**$ 156,600**	**$ 9,800**	**$ 183,000**	**$ 38,000**		**$ 41,250**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 10,000		$ 10,000			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 12,500		$ 12,500			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,400		$ 1,400	$ 5,600	75%	$ 4,200	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	high	$ 9,000		$ 9,000			$ -	Every 20 Years
Sandblast & Paint Pumps & Piping	medium		$ 33,000	$ 33,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -	$ 1,200	75%	$ 900	Every 20 Years
Packing Gland Cover Hardware Replacement				$ -	$ 600	75%	$ 450	Every 20 Years
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	45%	$ 4,050	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft	high	$ 25,000		$ 25,000			$ -	One Time Only
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 10,000	$ 10,000	100%	$ 10,000	
Sub-total		**$ 58,700**	**$ 33,000**	**$ 101,700**	**$ 38,800**		**$ 32,000**	

Table B4.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -	$ 28,000	75%	$ 21,000	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ 2,000	$ 2,000	$ 4,000	$ 44,000		$ 37,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling	low		$ 2,800	$ 2,800			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 13,900	$ 13,900			$ -	
Repair drywell floor/swale with new sloped concrete topping	low		$ 10,500	$ 10,500			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 4,400		$ 4,400			$ -	
Discharge box concrete repairs	medium	$ 3,300		$ 3,300			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 52,000	50%	$ 26,000	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	very high	$ 57,500		$ 57,500			$ -	Anchor bolts sheared
Install new access platforms for pump shaft guide bearings	medium	$ 11,000		$ 11,000			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 4,500	$ 4,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Inspect & upgrade/repair wetwell trashracks	medium	$ 7,500		$ 7,500			$ -	
Upgrade/repair wetwell ladders and railings	high	$ 5,000		$ 5,000			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 6,300			$ 7,500	
Sub-total		$ 90,900	$ 33,200	$ 130,400	$ 52,000		$ 33,500	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	Implement with exterior upgrades
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade				$ -			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 4,000	$ -	$ 5,200	$ 9,000		$ 9,000	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 424,300	$ 152,750	$ 577,050
Contingency (20%)	$ 84,860	$ 30,550	$ 115,410
Engineering & Administration (20%)	$ 84,860	$ 30,550	$ 115,410
Total Estimated Cost (Excluding PST & GST)	$ 594,020	$ 213,850	$ 807,870

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B5.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -	$ 11,500	100%	$ 11,500	1 future replacement
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing				$ -			$ -	
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)	medium	$ 345,000		$ 345,000			$ -	Scheduled for major aesthetic upgrade
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 11,500		$ 11,500			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)	medium	$ 2,300		$ 2,300			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 36,000			$ 5,000	
Sub-total		$ 358,800	$ -	$ 394,800	$ 15,000		$ 18,250	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 9,500		$ 9,500			$ -	One Time Only
Main Floor Cooling Fan System Upgrades				$ -			$ -	
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving				$ -			$ -	
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	medium	$ 66,000		$ 66,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -	$ 4,400	75%	$ 3,300	Every 20 Years
Discharge Pipe Replacement				$ -	$ 9,000	60%	$ 5,400	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct	high	$ 2,000		$ 2,000			$ -	One Time Only
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 900		$ 900	$ 3,600	100%	$ 3,600	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 12,500	$ 12,500	100%	$ 12,500	
Sub-total		$ 78,400	$ -	$ 90,900	$ 38,700		$ 34,000	

Table B5.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	Replace timber retaining wall
Additional Unidentified Scope Items				$ -	$ 26,000	100%	$ 26,000	
Sub-total		**$ 2,000**	**$ 2,000**	**$ 4,000**	**$ 42,000**		**$ 42,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 13,900	$ 13,900			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 5,500		$ 5,500			$ -	
Discharge box concrete repairs	medium	$ 6,600		$ 6,600			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 36,100	25%	$ 9,025	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 50,200	25%	$ 12,550	
Install new access platforms for pump shaft guide bearings	medium	$ 11,000		$ 11,000			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 3,000	$ 3,000			$ -	Assumed cost, could not dewater to inspect
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -			$ -	
Inspect & upgrade/repair wetwell trashracks	medium	$ 2,000		$ 2,000			$ -	Assumed cost, could not dewater to inspect
Upgrade/repair wetwell ladders and railings	medium	$ 3,750		$ 3,750			$ -	Assumed cost, could not dewater to inspect
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 31,050**	**$ 16,900**	**$ 52,950**	**$ 86,300**		**$ 26,575**	
Electrical								
Upgrade exterior lighting	medium	$ 2,000		$ 2,000	$ 5,000	100%	$ 5,000	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 26,400		$ 26,400			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 30,200**	**$ -**	**$ 31,400**	**$ 11,800**		**$ 11,800**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 574,050**		**$ 132,625**	**$ 706,675**
Contingency (20%)	$ 114,810		$ 26,525	$ 141,335
Engineering & Administration (20%)	$ 114,810		$ 26,525	$ 141,335
Total Estimated Cost (Excluding PST & GST)	**$ 803,670**		**$ 185,675**	**$ 989,345**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B6.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	medium	$ 18,400		$ 18,400	$ 18,400	100%	$ 18,400	1 future replacement
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)	medium	$ 8,100		$ 8,100			$ -	Roof trim upgrade
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing	low		$ 20,700	$ 20,700	$ 27,600	100%	$ 27,600	1 Repair & refinishing and 3 repairings
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	50%	$ 700	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -	$ 3,500	50%	$ 1,750	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800		$ 13,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 11,500	50%	$ 5,750	
Fencing repair, replacement or removal				$ -	$ 5,800	50%	$ 2,900	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 6,100			$ 6,200	
Sub-total		$ 40,300	$ 20,700	$ 67,100	$ 77,500		$ 67,950	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 10,500		$ 10,500			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 8,700		$ 8,700			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving				$ -			$ -	
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	medium	$ 43,300		$ 43,300			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	60%	$ 5,400	
Replace Worn Shaft Bearing and/or Universal Joints				$ -	$ 25,000	10%	$ 2,500	
Straighten or Replace Bent Shaft				$ -	$ 25,000	50%	$ 12,500	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	130%	$ 2,600	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000	10%	$ 500	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	10%	$ 500	
Align Misaligned Shaft				$ -	$ 5,000	10%	$ 500	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 900		$ 900	$ 3,600	100%	$ 3,600	Every 10 Years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 12,500	$ 12,500	100%	$ 12,500	
Sub-total		$ 65,700	$ -	$ 78,200	$ 101,300		$ 49,800	

Table B6.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -	$ 40,000	25%	$ 10,000	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ 2,000	$ 2,000	$ 4,000	$ 56,000		$ 26,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams				$ -	$ 21,600	50%	$ 10,800	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs				$ -	$ 7,300	50%	$ 3,650	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium		$ 2,200	$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 77,700	75%	$ 58,275	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	very high	$ 23,300		$ 23,300	$ 93,200	75%	$ 69,900	Anchor bolts sheared
Install new access platforms for pump shaft guide bearings	medium	$ 29,900		$ 29,900			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 2,500		$ 2,500			$ -	
Upgrade/repair wetwell ladders and railings				$ -	$ 10,000	75%	$ 7,500	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -	$ 100,000	75%	$ 75,000	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,600			$ 16,000	
Sub-total		$ 55,700	$ 3,700	$ 65,000	$ 312,800		$ 243,375	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 26,400		$ 26,400	$ 65,000	100%	$ 65,000	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 30,400	$ -	$ 31,600	$ 74,000		$ 74,000	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 245,900	$ 461,125	$ 707,025
Contingency (20%)	$ 49,180	$ 92,225	$ 141,405
Engineering & Administration (20%)	$ 49,180	$ 92,225	$ 141,405
Total Estimated Cost (Excluding PST & GST)	$ 344,260	$ 645,575	$ 989,835

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B7.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -	$ 5,800	50%	$ 2,900	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing				$ -	$ 9,200	100%	$ 9,200	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber	medium	$ 23,000		$ 23,000			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	50%	$ 700	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -	$ 3,500	50%	$ 1,750	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 17,300		$ 17,300			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)	medium	$ 2,300		$ 2,300			$ -	
Driveway and/or sidewalk repair or replacement	high	$ 10,000		$ 10,000			$ -	Exterior stair concrete
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 52,600**	**$ -**	**$ 57,600**	**$ 23,400**		**$ 21,300**	

Mechanical								
Drywell Ventilation System Upgrades	high	$ 10,000		$ 10,000			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 13,900		$ 13,900			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC	medium		$ 1,600	$ 1,600			$ -	One Time Only
Replace Existing Seal Water Valving	medium		$ 1,100	$ 1,100	$ 2,200	75%	$ 1,650	Every 20 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	high	$ 6,300		$ 6,300	$ 12,600	75%	$ 9,450	Every 20 Years
Sandblast & Paint Pumps & Piping	high	$ 33,000		$ 33,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -	$ 600	75%	$ 450	Every 20 Years
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- in to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	45%	$ 4,050	
Replace Worn Shaft Bearing and/or Universal Joints				$ -	$ 25,000	10%	$ 2,500	
Straighten or Replace Bent Shaft				$ -	$ 25,000	40%	$ 10,000	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	100%	$ 2,000	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000	10%	$ 500	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	10%	$ 500	
Align Misaligned Shaft				$ -	$ 5,000	10%	$ 500	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 10 Years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 10,000	$ 10,000	100%	$ 10,000	
Sub-total		**$ 66,300**	**$ 2,700**	**$ 79,000**	**$ 113,800**		**$ 54,000**	

Table B7.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -	$ 51,000	75%	$ 38,250	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 2,000**	**$ 2,000**	**$ 4,000**	**$ 67,000**		**$ 54,250**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches	medium	$ 1,100		$ 1,100			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 18,700	$ 18,700			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 4,400		$ 4,400			$ -	
Discharge box concrete repairs	medium	$ 6,400		$ 6,400			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 61,000	25%	$ 15,250	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 72,300	25%	$ 18,075	
Install new access platforms for pump shaft guide bearings	medium	$ 28,700		$ 28,700			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -	$ 6,000	75%	$ 4,500	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Inspect & upgrade/repair wetwell trashracks	medium	$ 5,000		$ 5,000	$ 7,500	75%	$ 5,625	
Upgrade/repair wetwell ladders and railings				$ -			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports	low		$ 75,000	$ 75,000			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,900			$ 5,000	
Sub-total		**$ 45,600**	**$ 95,200**	**$ 146,700**	**$ 146,800**		**$ 48,450**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 6,600		$ 6,600	$ 65,000	100%	$ 65,000	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 10,600**	**$ -**	**$ 11,800**	**$ 74,000**		**$ 74,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 299,100**		**$ 252,000**	**$ 551,100**
Contingency (20%)	$ 59,820		$ 50,400	$ 110,220
Engineering & Administration (20%)	$ 59,820		$ 50,400	$ 110,220
Total Estimated Cost (Excluding PST & GST)	**$ 418,740**		**$ 352,800**	**$ 771,540**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B8.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	medium	$ 13,800		$ 13,800	$ 13,800	100%	$ 13,800	
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing	medium	$ 3,500		$ 3,500	$ 13,800	100%	$ 13,800	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame	medium	$ 3,500		$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	25%	$ 350	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing	low		$ 3,500	$ 3,500	$ 5,800	50%	$ 2,900	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800		$ 13,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)	medium	$ 3,500		$ 3,500			$ -	Add intermediate rails on stairs and landing
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 6,900	50%	$ 3,450	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading	medium	$ 1,200		$ 1,200			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 39,300**	**$ 3,500**	**$ 47,800**	**$ 45,200**		**$ 41,050**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 10,000		$ 10,000			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 12,500		$ 12,500			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving				$ -			$ -	
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping				$ -			$ -	
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	30%	$ 2,700	
Replace Worn Shaft Bearing and/or Universal Joints				$ -	$ 25,000	10%	$ 2,500	
Straighten or Replace Bent Shaft				$ -	$ 25,000	30%	$ 7,500	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	70%	$ 1,400	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000	10%	$ 500	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	10%	$ 500	
Align Misaligned Shaft				$ -	$ 5,000	10%	$ 500	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 1,900		$ 1,900	$ 7,600	100%	$ 7,600	Every 10 Years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 7,500	$ 7,500	100%	$ 7,500	
Sub-total		**$ 26,700**	**$ -**	**$ 34,200**	**$ 100,300**		**$ 39,900**	

Table B8.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	To Follow
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers	high	$ 10,000	$ 10,000	$ 20,000			$ -	
Upgrde existing riprap blanket/install new riprap blanket	high	$ 78,000		$ 78,000			$ -	To Follow
Drainage Improvements				$ -			$ -	
Shear Key	nigh	$ 250,000		$ 250,000			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 340,000**	**$ 12,000**	**$ 352,000**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling	low		$ 2,800	$ 2,800			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 17,200	$ 17,200			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs	medium	$ 6,700		$ 6,700			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 49,000	25%	$ 12,250	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 63,900	75%	$ 47,925	
Install new access platforms for pump shaft guide bearings	medium	$ 10,700		$ 10,700			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -	$ 6,000	75%	$ 4,500	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500	$ 7,500	75%	$ 5,625	
Upgrade/repair wetwell ladders and railings	high	$ 2,000		$ 2,000			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports	low		$ 10,000	$ 10,000	$ 50,000	75%	$ 37,500	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 6,500	
Sub-total		**$ 23,100**	**$ 30,000**	**$ 58,100**	**$ 179,400**		**$ 116,550**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade				$ -			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 4,000**	**$ -**	**$ 5,200**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 497,300**		$ 222,500	**$ 719,800**
Contingency (20%)	$ 99,460		$ 44,500	$ 143,960
Engineering & Administration (20%)	$ 99,460		$ 44,500	$ 143,960
Total Estimated Cost (Excluding PST & GST)	**$ 696,220**		**$ 311,500**	**$ 1,007,720**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B9.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	medium	$ 10,400	$ -	$ 10,400	$ -		$ -	
Replace shingle roofing c/w new underlayment (including hatch)			$ -	$ -	$ -		$ -	
Roof trim repair or upgrade (including drainage system)		$ -	$ -	$ -	$ -		$ -	
Install new sloped prefinished metal roof & trim over existing flat roof		$ -	$ -	$ -	$ -		$ -	
Localized wood frame wall repair		$ -	$ -	$ -	$ -		$ -	
Exterior siding and/or trim refinishing	medium	$ 2,300	$ -	$ 2,300	$ 9,200	100%	$ 9,200	Every 10 years
Exterior siding and/or trim repair or replace with similar material		$ -	$ -	$ -	$ -		$ -	
Major aesthetic upgrade (and/or major building repair or alterations)		$ -	$ -	$ -	$ -		$ -	
Installation of separate access to sanitary sewer chamber		$ -	$ -	$ -	$ -		$ -	
Replace entry door and frame	medium	$ 3,500		$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame		$ -	$ -	$ -	$ 1,400	25%	$ 350	
Remove existing window and infill wall opening		$ -	$ -	$ -	$ -		$ -	
Create/rework wall openings for ventilation upgrades		$ -	$ -	$ -	$ -		$ -	
Minor brick repair and mortar joint repointing	medium	$ 3,500	$ -	$ 3,500	$ 5,800	50%	$ 2,900	
Wall repair and installation of flashing at discharge block		$ -	$ -	$ -	$ -		$ -	
Sealant joint replacement		$ -	$ -	$ -	$ -		$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800	$ -	$ 13,800	$ -		$ -	
Drywell stair safety upgrade (install intermediate rails on landings)	medium	$ 2,300	$ -	$ 2,300	$ -		$ -	Install intermediate rails at landing
Exterior stair safety upgrade (install handrails)		$ -	$ -	$ -	$ -		$ -	
Driveway and/or sidewalk repair or replacement		$ -	$ -	$ -	$ 4,600	50%	$ 2,300	
Fencing repair, replacement or removal		$ -	$ -	$ -	$ -		$ -	
Site regrading	medium	$ 1,200	$ -	$ 1,200	$ -		$ -	
Additional Unidentified Scope Items		$ -	$ -	$ 5,000	$ -		$ 5,000	
Sub-total		**$ 37,000**	**$ -**	**$ 42,000**	**$ 24,500**		**$ 21,500**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 9,500		$ 9,500			$ -	One time only
Main Floor Cooling Fan System Upgrades	medium	$ 11,800		$ 11,800			$ -	One time only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC	medium		$ 1,600	$ 1,600			$ -	One time only
Replace Existing Seal Water Valving	medium		$ 1,200	$ 1,200	$ 2,400	75%	$ 1,800	Every 20 years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	high	$ 1,400		$ 1,400	$ 2,800	75%	$ 2,100	Every 20 years
Sandblast & Paint Pumps & Piping	high	$ 34,300		$ 34,300			$ -	One time only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -	$ 600	75%	$ 450	Every 20 years
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	45%	$ 4,050	
Replace Worn Shaft Bearing and/or Universal Joints	high	$ 25,000		$ 25,000			$ -	One time only
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	high	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 20 years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 20 years
Additional Unidentified Scope Items				$ 10,000	$ 10,000	100%	$ 10,000	
Sub-total		**$ 82,800**	**$ 2,800**	**$ 95,600**	**$ 37,200**		**$ 30,800**	

Table B9.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket	medium		$ 62,000	$ 62,000			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 2,000**	**$ 64,000**	**$ 66,000**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 13,900	$ 13,900			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs	medium		$ 5,500	$ 5,500	$ 4,700	50%	$ 2,350	Not accessible for inspection
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 23,100	25%	$ 5,775	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	medium	$ 32,000		$ 32,000			$ -	
Install new access platforms for pump shaft guide bearings	medium	$ 16,500		$ 16,500			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -	$ 6,000	75%	$ 4,500	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 2,500		$ 2,500	$ 7,500	75%	$ 5,625	
Upgrade/repair wetwell ladders and railings				$ -			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports	low		$ 25,000	$ 25,000	$ 60,000	75%	$ 45,000	
Clean wetwell floor	medium	$ 2,500		$ 2,500			$ -	
Additional Unidentified Scope Items				$ 5,500			$ 5,000	
Sub-total		**$ 53,500**	**$ 44,400**	**$ 103,400**	**$ 104,300**		**$ 70,500**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade				$ -			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 4,000**	**$ -**	**$ 5,200**	**$ 9,000**		**$ 9,000**	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 312,200**	**$ 147,800**	**$ 460,000**
Contingency (20%)	$ 62,440	$ 29,560	$ 92,000
Engineering & Administration (20%)	$ 62,440	$ 29,560	$ 92,000
Total Estimated Cost (Excluding PST & GST)	**$ 437,080**	**$ 206,920**	**$ 644,000**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Appendix B10.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -	$ 13,800		$ -	2 future replacements
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing	medium	$ 3,500		$ 3,500	$ 13,800	100%	$ 13,800	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	Exterior renovated approximately 10 years ago
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing	medium	$ 5,800		$ 5,800	$ 5,800	100%	$ 5,800	
Wall repair and installation of flashing at discharge block	medium	$ 3,500		$ 3,500			$ -	Install flashing/weather barrier to rear of parapets
Sealant joint replacement	medium	$ 1,700		$ 1,700			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 8,100		$ 8,100			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 5,800	50%	$ 2,900	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items		$ -		$ 5,000			$ 5,000	
Sub-total		**$ 22,600**	**$ -**	**$ 27,600**	**$ 48,500**		**$ 32,150**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 10,000		$ 10,000			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 11,100		$ 11,100			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC		$ -		$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,200		$ 1,200	$ 2,400	75%	$ 1,800	Every 20 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flange Connection Nuts & Bolts	medium		$ 500	$ 500	$ 500	75%	$ 375	Every 30 Years
Sandblast & Paint Pumps & Piping	high	$ 34,000	$ -	$ 34,000			$ -	One Time Only
Bearing Cover Hardware Replacement	medium		$ 500	$ 500	$ 988	75%	$ 741	Every 20 Years
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- in to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	30%	$ 2,700	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 7,500	$ 7,500	100%	$ 7,500	
Sub-total		**$ 57,100**	**$ 1,000**	**$ 65,600**	**$ 32,788**		**$ 25,516**	

Appendix B10.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	To Follow
Install new inclinometers			$ -	$ -			$ -	
Monitoring of inclinometers	high	$ 10,000	$ 10,000	$ 20,000			$ -	
Upgrde existing riprap blanket/install new riprap blanket	high	$ 78,000		$ 78,000		0%	$ -	To Follow
Drainage Improvements				$ -			$ -	
Shear Key	high	$ 250,000		$ 250,000			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		**$ 340,000**	**$ 12,000**	**$ 352,000**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 10,000	$ 10,000			$ -	
Repair drywell floor/swale with new sloped concrete topping	low		$ 5,600	$ 5,600			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs	medium	$ 2,900		$ 2,900			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 29,300	75%	$ 21,975	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 40,700	50%	$ 20,350	
Install new access platforms for pump shaft guide bearings				$ -			$ -	Use portable ladder
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 4,500	$ 4,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500	$ 5,000	75%	$ 3,750	
Upgrade/repair wetwell ladders and railings	high	$ 5,000		$ 5,000			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 11,600**	**$ 20,100**	**$ 36,700**	**$ 78,000**		**$ 53,325**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200	$ -	$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800	$ -	$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 13,200		$ 13,200			$ -	
Additional Unidentified Scope Items			$ -	$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 17,200**	**$ -**	**$ 18,400**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 500,300**		**$ 135,991**	**$ 636,291**
Contingency (20%)	$ 100,060		$ 27,198	$ 127,258
Engineering & Administration (20%)	$ 100,060		$ 27,198	$ 127,258
Total Estimated Cost (Excluding PST & GST)	**$ 700,420**		**$ 190,387**	**$ 890,807**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B11.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -	$ 27,600	100%	$ 27,600	2 future replacements
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing	low		$ 2,300	$ 2,300	$ 9,200	100%	$ 9,200	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	Exterior renovated approximately 10 years ago
Installation of separate access to sanitary sewer chamber	medium	$ 69,000		$ 69,000			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	25%	$ 350	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing	low		$ 3,500	$ 3,500	$ 3,500	50%	$ 1,750	
Wall repair and installation of flashing at discharge block	medium	$ 3,500		$ 3,500			$ -	Install counter flashings to roof parapets
Sealant joint replacement	medium	$ 1,700		$ 1,700			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800		$ 13,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)	medium	$ 3,500		$ 3,500			$ -	Install intermediate rails
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 5,800	100%	$ 5,800	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 9,700			$ 5,000	
Sub-total		**$ 91,500**	**$ 5,800**	**$ 107,000**	**$ 56,800**		**$ 54,350**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 6,900		$ 6,900			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 11,100		$ 11,100			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	medium		$ 1,000	$ 1,000	$ 2,000	75%	$ 1,500	Every 20 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	medium		$ 500	$ 500	$ 500	75%	$ 375	Every 30 Years
Sandblast & Paint Pumps & Piping	high	$ 22,700		$ 22,700			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -			$ -	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes				$ -	$ 2,800	100%	$ 2,800	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 7,500	$ 7,500	100%	$ 7,500	
Sub-total		**$ 40,700**	**$ 1,500**	**$ 49,700**	**$ 22,000**		**$ 21,375**	

Table B11.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers	high	$ 2,500		$ 2,500			$ -	
Monitoring of inclinometers	high	$ 17,500	$ 2,000	$ 19,500			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ 22,000	$ 4,000	$ 26,000	$ 16,000		$ 16,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 8,800	$ 8,800			$ -	
Repair drywell floor/swale with new sloped concrete topping	low		$ 7,800	$ 7,800			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs	medium	$ 4,000		$ 4,000			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 26,000	75%	$ 19,500	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 32,000	25%	$ 8,000	
Install new access platforms for pump shaft guide bearings				$ -			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 6,000	$ 6,000			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks				$ -	$ 1,500	75%	$ 1,125	
Upgrade/repair wetwell ladders and railings				$ -	$ 3,750	75%	$ 2,813	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		$ 4,000	$ 22,600	$ 31,600	$ 66,250		$ 38,688	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 13,200		$ 13,200			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 17,200	$ -	$ 18,400	$ 9,000		$ 9,000	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 232,700	$ 139,413	$ 372,113
Contingency (20%)	$ 46,540	$ 27,883	$ 74,423
Engineering & Administration (20%)	$ 46,540	$ 27,883	$ 74,423
Total Estimated Cost (Excluding PST & GST)	$ 325,780	$ 195,178	$ 520,958

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B12.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -				
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -				
Exterior siding and/or trim refinishing				$ -	$ 9,200	100%	$ 9,200	every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	Station exterior completely renovated in 2005
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -	$ 3,500	50%	$ 1,750	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 8,100		$ 8,100			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading	medium	$ 2,500		$ 2,500			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 10,600**	**$ -**	**$ 15,600**	**$ 16,200**		**$ 17,700**	
Mechanical								
Drywell Ventilation System Upgrades	low	$ 5,100		$ 5,100			$ -	One Time Only
Main Floor Cooling Fan System Upgrades				$ -			$ -	
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,300		$ 1,300	$ 5,200	75%	$ 3,900	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	medium	$ 34,000		$ 34,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -	$ 800	75%	$ 600	Every 20 Years
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -	$ 4,400	75%	$ 3,300	Every 20 Years
Discharge Pipe Replacement				$ -	$ 9,000	30%	$ 2,700	
Replace Worn Shaft Bearing and/or Universal Joints				$ -	$ 25,000	10%	$ 2,500	
Straighten or Replace Bent Shaft				$ -	$ 25,000	30%	$ 7,500	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	70%	$ 1,400	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000	10%	$ 500	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	10%	$ 500	
Align Misaligned Shaft				$ -	$ 5,000	10%	$ 500	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 10 Years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 7,500	$ 7,500	100%	$ 7,500	
Sub-total		**$ 43,500**	**$ -**	**$ 51,000**	**$ 106,300**		**$ 43,300**	

Table B12.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers	high	$ 2,500		$ 2,500			$ -	
Monitoring of inclinometers	high	$ 5,000	$ 5,000	$ 10,000			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ 9,500	$ 7,000	$ 16,500	$ 16,000		$ 16,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 7,400	$ 7,400			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 2,200		$ 2,200			$ -	
Discharge box concrete repairs	medium	$ 5,100		$ 5,100			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 29,300	75%	$ 21,975	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	very high	$ 12,500		$ 12,500	$ 51,000	75%	$ 38,250	Anchor bolts sheared
Install new access platforms for pump shaft guide bearings				$ -			$ -	
Gate chamber concrete repairs	medium	$ 11,000		$ 11,000			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 4,500	$ 4,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500	$ 5,000	75%	$ 3,750	
Upgrade/repair wetwell ladders and railings				$ -	$ 3,750	75%	$ 2,813	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 6,500	
Sub-total		$ 32,300	$ 11,900	$ 49,200	$ 92,050		$ 75,538	
Electrical								
Upgrade exterior lighting				$ -	$ 2,200	100%	$ 2,200	
Upgrade interior lighting				$ -	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 13,200		$ 13,200				
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 13,200	$ -	$ 14,400	$ 9,000		$ 9,000	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 146,700	$ 161,538	$ 308,238
Contingency (20%)	$ 29,340	$ 32,308	$ 61,648
Engineering & Administration (20%)	$ 29,340	$ 32,308	$ 61,648
Total Estimated Cost (Excluding PST & GST)	$ 205,380	$ 226,153	$ 431,533

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B13.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -		100%	$ -	1 future replacement
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing				$ -	$ 27,600	100%	$ 27,600	3 repaintings after upgrade
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)	medium	$ 115,000		$ 115,000			$ -	Major aesthetic upgrade recommended
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800		$ 13,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)	medium	$ 2,300		$ 2,300			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 5,800	50%	$ 2,900	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 13,100			$ 5,000	
Sub-total		**$ 131,100**	**$ -**	**$ 144,200**	**$ 42,700**		**$ 40,150**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 9,500		$ 9,500			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 11,800		$ 11,800			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,400		$ 1,400	$ 5,600	75%	$ 4,200	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	high	$ 500		$ 500	$ 1,000	75%	$ 750	Every 20 Years
Sandblast & Paint Pumps & Piping	high	$ 50,000		$ 50,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	45%	$ 4,050	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall	high	$ 5,000		$ 5,000			$ -	One Time Only
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 900		$ 900	$ 3,600	100%	$ 3,600	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 10,000	$ 10,000	100%	$ 10,000	
Sub-total		**$ 79,100**	**$ -**	**$ 89,100**	**$ 38,400**		**$ 31,800**	

Table B13.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -	$ 49,500	100%	$ 49,500	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 2,000**	**$ 2,000**	**$ 4,000**	**$ 65,500**		**$ 65,500**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams				$ -	$ 12,300	50%	$ 6,150	
Repair drywell floor/swale with new sloped concrete topping	low		$ 10,500	$ 10,500			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs				$ -	$ 4,500	50%	$ 2,250	
Discharge stoplog and guide repairs	medium	$ 11,000		$ 11,000			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble	medium	$ 8,300		$ 8,300	$ 66,200	75%	$ 49,650	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	medium	$ 73,600		$ 73,600			$ -	
Install new access platforms for pump shaft guide bearings	medium	$ 7,900		$ 7,900			$ -	
Gate chamber concrete repairs	medium	$ 10,000		$ 10,000			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500	$ 5,000	75%	$ 3,750	
Upgrade/repair wetwell ladders and railings				$ -	$ 4,000	75%	$ 3,000	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 13,000			$ 6,500	
Sub-total		**$ 112,300**	**$ 13,500**	**$ 138,800**	**$ 92,000**		**$ 71,300**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 19,800		$ 19,800			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 23,800**	**$ -**	**$ 25,000**	**$ 9,000**		**$ 9,000**	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 401,100**	**$ 217,750**	**$ 618,850**
Contingency (20%)	$ 80,220	$ 43,550	$ 123,770
Engineering & Administration (20%)	$ 80,220	$ 43,550	$ 123,770
Total Estimated Cost (Excluding PST & GST)	**$ 561,540**	**$ 304,850**	**$ 866,390**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B14.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing				$ -			$ -	
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -			$ -	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell				$ -			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	
Mechanical								
Drywell Ventilation System Upgrades				$ -			$ -	
Main Floor Cooling Fan System Upgrades				$ -			$ -	
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving				$ -			$ -	
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping				$ -			$ -	
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -			$ -	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes				$ -			$ -	
Vibration Test and Thermal Scan				$ -	$ 2,600	100%	$ 2,600	Every 10 years
Additional Unidentified Scope Items				$ -				
Sub-total		$ -	$ -	$ -	$ 2,600		$ 2,600	

Table B14.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe				$ -	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ -	$ -	$ -	$ 16,000		$ 16,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams				$ -			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs				$ -			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -			$ -	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	very high	$ 32,100		$ 32,100			$ -	Anchor bolts sheared
Install new access platforms for pump shaft guide bearings				$ -			$ -	
Gate chamber concrete repairs	medium	$ 4,000		$ 4,000			$ -	Seal cold joint above flap gate
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -			$ -	
Inspect & upgrade/repair wetwell trashracks				$ -			$ -	
Upgrade/repair wetwell ladders and railings				$ -			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 6,600			$ -	
Sub-total		$ 36,100	$ -	$ 42,700	$ -		$ -	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade				$ -			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 4,000	$ -	$ 5,200	$ 9,000		$ 9,000	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 47,900	$ 27,600	$	75,500
Contingency (20%)	$ 9,580	$ 5,520	$	15,100
Engineering & Administration (20%)	$ 9,580	$ 5,520	$	15,100
Total Estimated Cost (Excluding PST & GST)	$ 67,060	$ 38,640	$	105,700

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B15.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	medium	$ 17,300		$ 17,300	$ 17,300	100%	$ 17,300	1 future replacement
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)	medium	$ 9,200		$ 9,200			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 11,500	50%	$ 5,750	
Exterior siding and/or trim refinishing	low		$ 20,700	$ 20,700	$ 27,600	100%	$ 27,600	1 Refinishing & 3 repaintings
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	100%	$ 3,500	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening	low		$ 3,500	$ 3,500			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 20,700		$ 20,700			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 9,200	50%	$ 4,600	
Fencing repair, replacement or removal				$ -	$ 5,800	50%	$ 2,900	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 7,100			$ 6,150	
Sub-total		**$ 47,200**	**$ 24,200**	**$ 78,500**	**$ 74,900**		**$ 67,800**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 12,400		$ 12,400			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 16,200		$ 16,200			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC	medium		$ 700	$ 700			$ -	One Time Only
Replace Existing Seal Water Valving	high	$ 1,700		$ 1,700	$ 6,800	75%	$ 5,100	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	medium	$ 82,000		$ 82,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- Into Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	75%	$ 6,750	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft	high	$ 50,000		$ 50,000			$ -	One Time Only
Assess Pump Bushing Clearances and Correct	high	$ 8,000		$ 8,000			$ -	One Time Only
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 1,000		$ 1,000	$ 4,000	100%	$ 4,000	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 15,000	$ 15,000	100%	$ 15,000	
Sub-total		**$ 171,300**	**$ 700**	**$ 187,000**	**$ 44,000**		**$ 40,050**	

Table B15.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrade existing riprap blanket/install new riprap blanket	low		$ 23,000	$ 23,000			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 2,000**	**$ 25,000**	**$ 27,000**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling	low		$ 2,800	$ 2,800			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 20,600	$ 20,600			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 2,200		$ 2,200			$ -	
Discharge box concrete repairs				$ -	$ 4,700	50%	$ 2,350	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 122,700	25%	$ 30,675	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 163,500	25%	$ 40,875	
Install new access platforms for pump shaft guide bearings	medium	$ 16,100		$ 16,100			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 2,500		$ 2,500	$ 10,000	75%	$ 7,500	
Upgrade/repair wetwell ladders and railings	high	$ 5,500		$ 5,500			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 7,400	
Sub-total		**$ 28,500**	**$ 24,900**	**$ 58,400**	**$ 303,900**		**$ 91,050**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 32,900		$ 32,900			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 36,900**	**$ -**	**$ 38,100**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 389,000**	**$ 223,900**		**$ 612,900**
Contingency (20%)	$ 77,800	$ 44,780		$ 122,580
Engineering & Administration (20%)	$ 77,800	$ 44,780		$ 122,580
Total Estimated Cost (Excluding PST & GST)	**$ 544,600**	**$ 313,460**		**$ 858,060**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B16.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	low		$ 11,500	$ 11,500	$ 11,500	100%	$ 11,500	
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing	medium	$ 4,600		$ 4,600	$ 18,400	100%	$ 18,400	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame	medium	$ 3,500		$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	25%	$ 350	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -	$ 5,800	50%	$ 2,900	
Wall repair and installation of flashing at discharge block	medium	$ 3,500		$ 3,500			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 11,500		$ 11,500			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)	medium	$ 2,300		$ 2,300			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 5,800	50%	$ 2,900	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 25,400**	**$ 11,500**	**$ 41,900**	**$ 46,400**		**$ 42,800**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 10,000		$ 10,000			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 13,900		$ 13,900			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC	medium		$ 1,600	$ 1,600			$ -	One Time Only
Replace Existing Seal Water Valving	medium		$ 1,300	$ 1,300	$ 2,600	75%	$ 1,950	Every 20 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	high	$ 33,000		$ 33,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -	$ 4,400	75%	$ 3,300	Every 20 Years
Discharge Pipe Replacement				$ -	$ 17,400	100%	$ 17,400	One Time Only
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium		$ 800	$ 800	$ 6,400	100%	$ 6,400	Every 5 Years
Vibration Test and Thermal Scan	low			$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 10,000	$ 10,000	100%	$ 10,000	
Sub-total		**$ 56,900**	**$ 3,700**	**$ 70,600**	**$ 50,000**		**$ 48,250**	

Table B16.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 5,000	$ 5,000	$ 10,000	$ 16,000	100%	$ 16,000	
Install new inclinometers	high	$ 4,500		$ 4,500			$ -	Two required in total
Monitoring of inclinometers	high	$ 5,000	$ 5,000	$ 10,000	$ 16,000	100%	$ 16,000	
Upgrde existing riprap blanket/install new riprap blanket				$ -	$ 89,000	25%	$ 22,000	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 14,500**	**$ 10,000**	**$ 24,500**	**$ 121,000**		**$ 54,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams				$ -	$ 19,300	50%	$ 9,650	
Repair dryweli floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 4,400		$ 4,400			$ -	
Discharge box concrete repairs				$ -	$ 3,300	50%	$ 1,650	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 68,600	50%	$ 34,300	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 94,500	100%	$ 94,500	
Install new access platforms for pump shaft guide bearings	medium	$ 19,100		$ 19,100			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 2,500		$ 2,500	$ 10,000	75%	$ 7,500	
Upgrade/repair wetwell ladders and railings	high	$ 1,000		$ 1,000			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports	low		$ 50,000	$ 50,000			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 8,000			$ 5,000	
Sub-total		**$ 27,000**	**$ 51,500**	**$ 86,500**	**$ 198,700**		**$ 154,850**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	Implement with exterior upgrades
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade				$ -			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 4,000**	**$ -**	**$ 5,200**	**$ 9,000**		**$ 9,000**	
								Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)				**$ 228,700**			**$ 308,900**	**$ 537,600**
Contingency (20%)				$ 45,740			$ 61,780	$ 107,520
Engineering & Administration (20%)				$ 45,740			$ 61,780	$ 107,520
Total Estimated Cost (Excluding PST & GST)				**$ 320,180**			**$ 432,460**	**$ 752,640**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table 5.18 - Estimated 10 Year & Future Upgrade Costs

NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing				$ -			$ -	
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -			$ -	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell				$ -			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	
Mechanical								
Drywell Ventilation System Upgrades				$ -			$ -	
Main Floor Cooling Fan System Upgrades				$ -			$ -	
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving				$ -			$ -	
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping				$ -			$ -	
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -			$ -	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes				$ -			$ -	
Vibration Test and Thermal Scan				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ -	$ -	$ -	$ -	$ -	$ -	

Table 5.18 - Estimated 10 Year & Future Upgrade Costs

NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe				$ -			$ -	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ -	$ -	$ -	$ -		$ -	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams				$ -			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs				$ -			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -			$ -	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -			$ -	
Install new access platforms for pump shaft guide bearings				$ -			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -			$ -	
Inspect & upgrade/repair wetwell trashracks				$ -			$ -	
Upgrade/repair wetwell ladders and railings				$ -			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	
Electrical								
Upgrade exterior lighting				$ -			$ -	
Upgrade interior lighting				$ -			$ -	
Service entrance upgrade							$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ -	$ -		$ -
Contingency (20%)	$ -	$ -		$ -
Engineering & Administration (20%)	$ -	$ -		$ -
Total Estimated Cost (Excluding PST & GST)	$ -	$ -		$ -

Table B18.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	low		$ 4,600	$ 4,600	$ 4,600	100%	$ 4,600	1 future replacement
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)	low		$ 2,900	$ 2,900			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing	low		$ 6,900	$ 6,900	$ 13,800	100%	$ 13,800	1 refinishing & 3 repaintings
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame	medium	$ 3,500		$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening	low		$ 2,900	$ 2,900			$ -	Replace in-filled areas with siding to match
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 5,800		$ 5,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 5,800	50%	$ 2,900	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 9,300**	**$ 17,300**	**$ 31,600**	**$ 33,500**		**$ 30,950**	

Mechanical								
Drywell Ventilation System Upgrades	medium	$ 4,600		$ 4,600			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 10,300		$ 10,300			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,000		$ 1,000	$ 4,000	75%	$ 3,000	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	high	$ 500		$ 500	$ 1,000	75%	$ 750	Every 20 Years
Sandblast & Paint Pumps & Piping	medium	$ 18,000		$ 18,000			$ -	One Time Only
Bearing Cover Hardware Replacement	low			$ -	$ 400	75%	$ 300	Every 20 Years
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	15%	$ 1,350	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct	high	$ 2,000		$ 2,000			$ -	One Time Only
Lower Shaft Bearing to Clear Shaft Coupling	high	$ 5,000		$ 5,000			$ -	One Time Only
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 5,000	$ 5,000	100%	$ 5,000	
Sub-total		**$ 42,200**	**$ -**	**$ 47,200**	**$ 31,800**		**$ 22,800**	

Table B18.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -	$ 37,000	100%	$ 37,000	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 2,000**	**$ 2,000**	**$ 4,000**	**$ 53,000**		**$ 53,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 13,600	$ 13,600			$ -	
Repair drywell floor/swale with new sloped concrete topping	low		$ 6,000	$ 6,000			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 4,400		$ 4,400			$ -	
Discharge box concrete repairs	medium	$ 2,100		$ 2,100			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 9,000	25%	$ 2,250	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 12,500	25%	$ 3,125	
Install new access platforms for pump shaft guide bearings	medium	$ 16,000		$ 16,000			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500	$ 5,000	75%	$ 3,750	
Upgrade/repair wetwell ladders and railings	high	$ 3,750		$ 3,750			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor	medium	$ 1,500		$ 1,500			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 31,450**	**$ 21,100**	**$ 57,550**	**$ 29,500**		**$ 16,375**	
Electrical								
Upgrade exterior lighting	medium		$ 2,200	$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium		$ 1,800	$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade				$ -			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ -**	**$ 4,000**	**$ 5,200**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 145,550**		**$ 132,125**	**$ 277,675**
Contingency (20%)	$ 29,110		$ 26,425	$ 55,535
Engineering & Administration (20%)	$ 29,110		$ 26,425	$ 55,535
Total Estimated Cost (Excluding PST & GST)	**$ 203,770**		**$ 184,975**	**$ 388,745**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B19.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)	high	$ 5,800		$ 5,800	$ 5,800	100%	$ 5,800	
Roof trim repair or upgrade (including drainage system)	medium	$ 4,600		$ 4,600			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing				$ -	$ 23,000	100%	$ 23,000	4 repaintings
Exterior siding and/or trim repair or replace with similar material	medium	$ 20,700		$ 20,700			$ -	Siding replacement and painting
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber	medium	$ 46,000		$ 46,000			$ -	
Replace entry door and frame	medium	$ 3,500		$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	25%	$ 350	
Remove existing window and infill wall opening	medium	$ 3,500		$ 3,500			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block	medium	$ 7,000		$ 7,000			$ -	And at gate chamber
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 18,400		$ 18,400			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)	medium	$ 2,300		$ 2,300			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 5,800	50%	$ 2,900	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading			$ 5,800	$ 5,800			$ -	
Additional Unidentified Scope Items				$ 11,400			$ 5,000	
Sub-total		**$ 111,800**	**$ 5,800**	**$ 129,000**	**$ 45,300**		**$ 41,700**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 9,500		$ 9,500			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	medium	$ 11,800		$ 11,800			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,200		$ 1,200	$ 4,800	75%	$ 3,600	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	medium		$ 4,900	$ 4,900	$ 4,900	75%	$ 3,675	Every 30 Years
Sandblast & Paint Pumps & Piping	high	$ 22,700		$ 22,700			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -	$ 1,300	75%	$ 975	Every 20 Years
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -	$ 400	75%	$ 300	Every 20 Years
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -	$ 4,400	75%	$ 3,300	Every 20 Years
Discharge Pipe Replacement				$ -			$ -	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes				$ -	$ 2,800	100%	$ 2,800	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 7,500	$ 7,500	100%	$ 7,500	
Sub-total		**$ 45,200**	**$ 4,900**	**$ 57,600**	**$ 35,300**		**$ 31,350**	

Table B19.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -	$ 26,000	50%	$ 13,000	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 2,000**	**$ 2,000**	**$ 4,000**	**$ 42,000**		**$ 29,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 10,800	$ 10,800			$ -	
Repair drywell floor/swale with new sloped concrete topping	low		$ 10,700	$ 10,700			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 2,200		$ 2,200			$ -	
Discharge box concrete repairs	medium	$ 6,500		$ 6,500			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 36,000	75%	$ 27,000	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	very high	$ 72,300		$ 72,300			$ -	Anchor bolts sheared
Install new access platforms for pump shaft guide bearings	medium	$ 8,000		$ 8,000			$ -	
Gate chamber concrete repairs	medium	$ 10,000		$ 10,000			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 6,000	$ 6,000			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500			$ -	
Upgrade/repair wetwell ladders and railings	high	$ 3,750		$ 3,750			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 11,300			$ 5,000	
Sub-total		**$ 106,450**	**$ 27,500**	**$ 145,250**	**$ 39,000**		**$ 34,250**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 13,200		$ 13,200			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 17,200**	**$ -**	**$ 18,400**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 354,250**		**$ 145,300**	**$ 499,550**
Contingency (20%)	$ 70,850		$ 29,060	$ 99,910
Engineering & Administration (20%)	$ 70,850		$ 29,060	$ 99,910
Total Estimated Cost (Excluding PST & GST)	**$ 495,950**		**$ 203,420**	**$ 699,370**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B20.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -	$ 8,100	100%	$ 8,100	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 11,500	50%	$ 5,750	
Exterior siding and/or trim refinishing				$ -	$ 27,600		$ -	
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)	low		$ 200,000	$ 200,000			$ -	Major aesthetic upgrade with SPS
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -	$ 5,800	50%	$ 2,900	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 11,500		$ 11,500			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)	medium	$ 2,300		$ 2,300			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 23,000	75%	$ 17,250	
Fencing repair, replacement or removal				$ -	$ 11,500	50%	$ 5,750	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 5,200			$ 5,000	
Sub-total		**$ 13,800**	**$ 200,000**	**$ 219,000**	**$ 91,000**		**$ 46,500**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 9,500		$ 9,500			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 11,800		$ 11,800			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	medium		$ 1,200	$ 1,200	$ 2,400	75%	$ 1,800	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	high	$ 22,700		$ 22,700			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	30%	$ 2,700	
Replace Worn Shaft Bearing and/or Universal Joints				$ -	$ 25,000	10%	$ 2,500	
Straighten or Replace Bent Shaft				$ -	$ 25,000	30%	$ 7,500	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	70%	$ 1,400	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000	10%	$ 500	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	10%	$ 500	
Align Misaligned Shaft				$ -	$ 5,000	10%	$ 500	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 700		$ 700	$ 2,800	100%	$ 2,800	Every 10 Years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 7,500	$ 7,500	100%	$ 7,500	
Sub-total		**$ 47,000**	**$ 1,200**	**$ 55,700**	**$ 97,900**		**$ 36,900**	

Table B20.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 32,000	100%	$ 32,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers	medium	$ 5,000	$ 5,000	$ 10,000			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ 7,000	$ 7,000	$ 14,000	$ 32,000		$ 32,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 15,400	$ 15,400			$ -	Includes beam repair
Repair drywell floor/swale with new sloped concrete topping	low		$ 10,000	$ 10,000			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 4,400		$ 4,400			$ -	
Discharge box concrete repairs	medium	$ 3,700		$ 3,700			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 70,800	25%	$ 17,700	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 86,600	25%	$ 21,650	
Install new access platforms for pump shaft guide bearings	medium	$ 8,000		$ 8,000			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 3,000	$ 3,000			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500			$ -	
Upgrade/repair wetwell ladders and railings	high	$ 3,750		$ 3,750			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		$ 23,550	$ 28,400	$ 56,950	$ 160,400		$ 46,600	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 13,200		$ 13,200			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 17,200	$ -	$ 18,400	$ 9,000		$ 9,000	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 364,050		$ 171,000	$ 535,050
Contingency (20%)	$ 72,810		$ 34,200	$ 107,010
Engineering & Administration (20%)	$ 72,810		$ 34,200	$ 107,010
Total Estimated Cost (Excluding PST & GST)	$ 509,670		$ 239,400	$ 749,070

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B21.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -	$ 18,400	100%	$ 18,400	2 future replacements
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)	high	$ 2,300		$ 2,300	$ 6,900	50%	$ 3,450	Extend rainwater leader & wash stone
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 11,500	50%	$ 5,750	
Exterior siding and/or trim refinishing	low		$ 2,300	$ 2,300	$ 9,200	100%	$ 9,200	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ 2,000	$ 5,800	50%	$ 2,900	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800		$ 13,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 5,800	50%	$ 2,900	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 16,100**	**$ 2,300**	**$ 25,400**	**$ 61,100**		**$ 49,350**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 10,000		$ 10,000			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 13,900		$ 13,900			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,300		$ 1,300	$ 5,200	75%	$ 3,900	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	medium		$ 5,400	$ 5,400	$ 5,400	75%	$ 4,050	Every 30 Years
Sandblast & Paint Pumps & Piping	high	$ 33,000		$ 33,000			$ -	One Time Only
Bearing Cover Hardware Replacement	medium		$ 700	$ 700	$ 1,400	75%	$ 1,050	Every 20 Years
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- in to Pump(s)				$ -	$ 600	75%	$ 450	Every 20 Years
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	45%	$ 4,050	
Replace Worn Shaft Bearing and/or Universal Joints				$ -	$ 25,000	10%	$ 2,500	
Straighten or Replace Bent Shaft				$ -	$ 25,000	40%	$ 10,000	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	100%	$ 2,000	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000	10%	$ 500	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	10%	$ 500	
Align Misaligned Shaft				$ -	$ 5,000	10%	$ 500	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 10 Years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 10,000	$ 10,000	100%	$ 10,000	
Sub-total		**$ 61,300**	**$ 6,100**	**$ 77,400**	**$ 111,000**		**$ 51,900**	

Table B21.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers	high	$ 10,000	$ 10,000	$ 20,000			$ -	
Upgrde existing riprap blanket/install new riprap blanket	high	$ 78,000		$ 78,000			$ -	
Drainage Improvements				$ -			$ -	
Shear Key	high	$ 250,000		$ 250,000			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 340,000**	**$ 12,000**	**$ 352,000**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches	high	$ 200		$ 200			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 16,700	$ 16,700			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 4,400		$ 4,400			$ -	
Discharge box concrete repairs	medium	$ 5,300		$ 5,300			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 44,000	75%	$ 33,000	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 66,000	75%	$ 49,500	
Install new access platforms for pump shaft guide bearings	medium		$ 8,300	$ 8,300			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -	$ 6,000	75%	$ 4,500	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)	low		$ 3,000	$ 3,000			$ -	
Inspect & upgrade/repair wetwell trashracks	medium	$ 7,500		$ 7,500			$ -	
Upgrade/repair wetwell ladders and railings	high	$ 5,000		$ 5,000			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 9,000	
Sub-total		**$ 22,400**	**$ 28,000**	**$ 55,400**	**$ 116,000**		**$ 96,000**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 19,800		$ 19,800			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 23,800**	**$ -**	**$ 25,000**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 535,200**		**$ 222,250**	**$ 757,450**
Contingency (20%)	$ 107,040		$ 44,450	$ 151,490
Engineering & Administration (20%)	$ 107,040		$ 44,450	$ 151,490
Total Estimated Cost (Excluding PST & GST)	**$ 749,280**		**$ 311,150**	**$ 1,060,430**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B22.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -	$ 32,200		$ -	2 future replacements
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)	medium	$ 3,500		$ 3,500			$ -	Repair parapet sealant joint
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing	low		$ 3,500	$ 3,500	$ 13,800		$ -	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 5,800	50%	$ 2,900	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing	medium	$ 2,300		$ 2,300	$ 11,500	50%	$ 5,750	Clean out wall drainage holes (0 to 5 years)
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement	low		$ 6,900	$ 6,900	$ 20,700	100%	$ 20,700	Every 10 years
Install thermal barrier over foamed plastic insulation in drywell				$ -			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		$ 5,800	$ 10,400	$ 21,200	$ 84,000		$ 34,350	
Mechanical								
Drywell Ventilation System Upgrades				$ -			$ -	
Main Floor Cooling Fan System Upgrades				$ -			$ -	
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving				$ -			$ -	
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping				$ -			$ -	
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	15%	$ 1,350	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -	$ 25,000	10%	$ 2,500	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	30%	$ 600	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000		$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	5%	$ 250	
Align Misaligned Shaft				$ -	$ 5,000	5%	$ 250	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes				$ -	$ 2,800	100%	$ 2,800	Every 10 Years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 5,000	$ 5,000	100%	$ 5,000	
Sub-total		$ 2,300	$ -	$ 7,300	$ 68,000		$ 21,950	

Table B22.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -	$ 30,000	75%	$ 22,500	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ 2,000	$ 2,000	$ 4,000	$ 46,000		$ 38,500	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams				$ -			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs				$ -			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 23,100	25%	$ 5,775	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 32,100	50%	$ 16,050	
Install new access platforms for pump shaft guide bearings				$ -			$ -	
Gate chamber concrete repairs	very high	$ 3,900		$ 3,900			$ -	Remove gate chamber silt
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 3,000	$ 3,000			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks				$ -			$ -	
Upgrade/repair wetwell ladders and railings	high	$ 500		$ 500			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor	medium	$ 1,500		$ 1,500			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		$ 5,900	$ 3,000	$ 13,900	$ 58,200		$ 29,075	
Electrical								
Upgrade exterior lighting				$ -	$ 1,800	100%	$ 1,800	
Upgrade interior lighting				$ -	$ 2,200	100%	$ 2,200	
Service entrance upgrade				$ -				
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ -	$ -	$ 1,200	$ 9,000		$ 9,000	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 47,600	$ 132,875	$ 180,475
Contingency (20%)	$ 9,520	$ 26,575	$ 36,095
Engineering & Administration (20%)	$ 9,520	$ 26,575	$ 36,095
Total Estimated Cost (Excluding PST & GST)	$ 66,640	$ 186,025	$ 252,665

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B23.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -	$ 8,100	100%	$ 8,100	2 future replacements
Roof trim repair or upgrade (including drainage system)				$ -	$ 4,100	100%	$ 4,100	Upgrade roof trim & soffit at first reroofing
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing	medium	$ 9,200		$ 9,200	$ 18,400	100%	$ 18,400	1 refinishing & 4 repaintings
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame	medium	$ 3,500		$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 6,900		$ 6,900			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading	low		$ 2,300	$ 2,300			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 19,600**	**$ 2,300**	**$ 26,900**	**$ 39,900**		**$ 40,250**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 9,500		$ 9,500			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 11,100		$ 11,100			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	medium		$ 1,200	$ 1,200	$ 2,400	75%	$ 1,800	Every 20 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	high	$ 1,500		$ 1,500	$ 3,000	75%	$ 2,250	Every 20 Years
Sandblast & Paint Pumps & Piping	high	$ 34,000		$ 34,000			$ -	One Time Only
Bearing Cover Hardware Replacement	medium		$ 400	$ 400	$ 800	75%	$ 600	Every 20 Years
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	30%	$ 2,700	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct	high	$ 4,000		$ 4,000			$ -	One Time Only
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 7,500	$ 7,500	100%	$ 7,500	
Sub-total		**$ 60,900**	**$ 1,600**	**$ 70,000**	**$ 35,100**		**$ 27,250**	

Table B23.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 2,000**	**$ 2,000**	**$ 4,000**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 10,700	$ 10,700			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 3,300		$ 3,300			$ -	
Discharge box concrete repairs	low		$ 4,600	$ 4,600			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 500		$ 500			$ -	Re-open existing vents
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 29,300	25%	$ 7,325	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 31,100	25%	$ 7,775	
Install new access platforms for pump shaft guide bearings	medium	$ 11,000		$ 11,000			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500			$ -	
Upgrade/repair wetwell ladders and railings	high	$ 2,500		$ 2,500	$ 2,500	75%	$ 1,875	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 18,800**	**$ 16,800**	**$ 40,600**	**$ 65,900**		**$ 24,225**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 13,200		$ 13,200			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 17,200**	**$ -**	**$ 18,400**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 159,900**	**$ 116,725**		**$ 276,625**
Contingency (20%)	$ 31,980	$ 23,345		$ 55,325
Engineering & Administration (20%)	$ 31,980	$ 23,345		$ 55,325
Total Estimated Cost (Excluding PST & GST)	**$ 223,860**	**$ 163,415**		**$ 387,275**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B24.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -	$ 20,700	100%	$ 20,700	2 future replacements
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -	$ 4,600	100%	$ 4,600	Upgrade roofing trim at first reroofing
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair	medium	$ 6,900		$ 6,900	$ 11,500	50%	$ 5,750	
Exterior siding and/or trim refinishing	medium	$ 16,100		$ 16,100	$ 36,800	100%	$ 36,800	1 refinishing & 4 repaintings
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame	medium	$ 3,500		$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening	medium	$ 3,500		$ 3,500			$ -	Upgrade existing in-fills with siding to match
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block	low		$ 3,500	$ 3,500			$ -	Upgrade flashing above discharge blocks
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 11,500		$ 11,500			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 6,950	
Sub-total		**$ 41,500**	**$ 3,500**	**$ 50,000**	**$ 77,100**		**$ 76,550**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 9,500		$ 9,500			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 12,500		$ 12,500			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,400		$ 1,400	$ 5,600	75%	$ 4,200	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	medium		$ 5,500	$ 5,500	$ 5,500	75%	$ 4,125	Every 30 Years
Sandblast & Paint Pumps & Piping	high	$ 33,000		$ 33,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -	$ 1,400	75%	$ 1,050	Every 20 Years
Packing Gland Cover Hardware Replacement				$ -	$ 600	75%	$ 450	Every 20 Years
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- in to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	45%	$ 4,050	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 10,000	$ 10,000	100%	$ 10,000	
Sub-total		**$ 57,200**	**$ 5,500**	**$ 72,700**	**$ 44,500**		**$ 36,275**	

Table B24.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -	$ 22,000	50%	$ 11,000	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ 2,000	$ 2,000	$ 4,000	$ 38,000		$ 27,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling	low		$ 2,800	$ 2,800			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 10,700	$ 10,700			$ -	
Repair drywell floor/swale with new sloped concrete topping	low		$ 12,700	$ 12,700			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs	medium	$ 6,100		$ 6,100			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 44,100	75%	$ 33,075	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	high	$ 5,500		$ 5,500	$ 81,000	75%	$ 60,750	
Install new access platforms for pump shaft guide bearings	medium	$ 11,000		$ 11,000			$ -	
Gate chamber concrete repairs	medium		$ 11,000	$ 11,000			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 4,500	$ 4,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Inspect & upgrade/repair wetwell trashracks	medium	$ 7,500		$ 7,500			$ -	
Upgrade/repair wetwell ladders and railings	high	$ 5,000		$ 5,000			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 6,000			$ 9,400	
Sub-total		$ 35,100	$ 43,200	$ 84,300	$ 125,100		$ 103,225	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 19,800		$ 19,800			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 23,800	$ -	$ 25,000	$ 9,000		$ 9,000	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 236,000	$ 252,050	$ 488,050
Contingency (20%)	$ 47,200	$ 50,410	$ 97,610
Engineering & Administration (20%)	$ 47,200	$ 50,410	$ 97,610
Total Estimated Cost (Excluding PST & GST)	$ 330,400	$ 352,870	$ 683,270

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table 5.26 - Estimated 10 Year & Future Upgrade Costs

NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing				$ -			$ -	
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -			$ -	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell				$ -			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	
Mechanical								
Drywell Ventilation System Upgrades				$ -			$ -	
Main Floor Cooling Fan System Upgrades				$ -			$ -	
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving				$ -			$ -	
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping				$ -			$ -	
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -			$ -	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes				$ -			$ -	
Vibration Test and Thermal Scan				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ -	$ -	$ -	$ -	$ -	$ -	

Table 5.26 - Estimated 10 Year & Future Upgrade Costs

NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe				$ -			$ -	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope items				$ -				
Sub-total		$ -	$ -	$ -	$ -		$ -	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams				$ -			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs				$ -			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -			$ -	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -			$ -	
Install new access platforms for pump shaft guide bearings				$ -			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -			$ -	
Inspect & upgrade/repair wetwell trashracks				$ -			$ -	
Upgrade/repair wetwell ladders and railings				$ -			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	
Electrical								
Upgrade exterior lighting				$ -			$ -	
Upgrade interior lighting				$ -			$ -	
Service entrance upgrade							$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ -		$ -	$ -
Contingency (20%)	$ -		$ -	$ -
Engineering & Administration (20%)	$ -		$ -	$ -
Total Estimated Cost (Excluding PST & GST)	$ -		$ -	$ -

Table B26.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -	$ 12,700	100%	$ 12,700	2 future replacements
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing				$ -	$ 27,600	100%	$ 27,600	3 repaintings after upgrade
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)	medium	$ 69,000		$ 69,000			$ -	
Installation of separate access to sanitary sewer chamber	medium	$ 46,000		$ 46,000			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	25%	$ 350	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800		$ 13,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)	medium	$ 2,300		$ 2,300			$ -	
Exterior stair safety upgrade (install handrails)	medium	$ 2,300		$ 2,300			$ -	
Driveway and/or sidewalk repair or replacement				$ -				
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 13,400			$ 5,000	
Sub-total		**$ 133,400**	**$ -**	**$ 146,800**	**$ 51,000**		**$ 50,300**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 9,500		$ 9,500			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	medium	$ 11,800		$ 11,800			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,200		$ 1,200	$ 4,800	75%	$ 3,600	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	high	$ 10,400		$ 10,400	$ 9,400	75%	$ 7,050	Every 20 Years
Sandblast & Paint Pumps & Piping	high	$ 22,700		$ 22,700			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -	$ 800	75%	$ 600	Every 20 Years
Packing Gland Cover Hardware Replacement	medium		$ 200	$ 200	$ 400	75%	$ 300	Every 20 Years
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -	$ 400	50%	$ 200	Every 20 Years
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -	$ 4,400	75%	$ 3,300	Every 20 Years
Discharge Pipe Replacement				$ -			$ -	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Remstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes				$ -	$ 2,800	100%	$ 2,800	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 7,500	$ 7,500	100%	$ 7,500	
Sub-total		**$ 55,600**	**$ 200**	**$ 63,300**	**$ 39,700**		**$ 34,550**	

Table B26.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket	medium		$ 38,000	$ 38,000			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items	medium		$ 5,000	$ 5,000			$ -	Drainage Improvments
Sub-total		$ 2,000	$ 45,000	$ 47,000	$ 16,000		$ 16,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling	low		$ 3,900	$ 3,900			$ -	Includes beam repair
Upgrade/repair drywell stairs/ladders/handrails/hatches	medium	$ 1,700		$ 1,700			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 13,200	$ 13,200			$ -	Includes beam repair
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 4,400		$ 4,400			$ -	
Discharge box concrete repairs	medium	$ 6,100		$ 6,100			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 52,000	75%	$ 39,000	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	very high	$ 12,500		$ 12,500	$ 50,200	75%	$ 37,650	Anchor bolts sheared
Install new access platforms for pump shaft guide bearings	medium	$ 8,900		$ 8,900			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 3,000	$ 3,000			$ -	
Repair wetwell intermediate slab and beam, floor slab and oulvert (cracks and or spalling)				$ -	$ 3,000	75%	$ -	
Inspect & upgrade/repair wetwell trashracks				$ -			$ -	
Upgrade/repair wetwell ladders and railings	medium	$ 1,000		$ 1,000			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,300			$ 8,900	
Sub-total		$ 36,800	$ 20,100	$ 62,200	$ 105,200		$ 85,550	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 13,200		$ 13,200			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 17,200	$ -	$ 18,400	$ 9,000		$ 9,000	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 337,700	$ 195,400	$	533,100
Contingency (20%)	$ 67,540	$ 39,080	$	106,620
Engineering & Administration (20%)	$ 67,540	$ 39,080	$	106,620
Total Estimated Cost (Excluding PST & GST)	$ 472,780	$ 273,560	$	746,340

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Item #	Description	Year									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Flood Pumping Station Upgrades										
1.0	**High and Very High Priority Upgrades**										
2.0	**North Area FPS Upgrades**										
	Assiniboine										
	Aubrey										
	Bannatyne										
	Clifton										
	Colony										
	Cornish										
	Galt (Building Upgrade Completed 2005)										
	Jefferson										
	Newton										
	Polson										
	Selkirk										
	St. John's										
	Syndicate										
3.0	**East Area FPS Upgrades**										
	Despins										
	Dumoulin										
	Hart										
	Hawthorne (Station Upgrade Completed 2006)										
	Laverendrye										
	Linden										
	Mager										
	Marion										
	Mayfair										
	Metcalfe										
	Mission										
	Roland										
4.0	**South Area FPS Upgrades**										
	Ash										
	Baltimore										
	Cockburn										
	Jessie										
5.0	**Geotechnical Upgrades**										

Flood Pumping Station Condition Assessment
Station Based 10 Year Work Program

DRAWING 5.1

Item #	Description	Year									
		2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
	Flood Pumping Station Upgrades										
1.0	High and Very High Priority Upgrades										
2.0	Building and Site Upgrades										
3.0	Mechanical/Electrical Upgrades										
4.0	Geotechnical Upgrades										
5.0	Substructure and Gates Upgrades										

Flood Pumping Stn. Condition Assessment
Work Area Based 10 Year Work Program

DRAWING 5.2

Table B27.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -	$ 13,800	100%	$ 13,800	2 future replacements
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing				$ -	$ 27,600	100%	$ 27,600	3 repaintings after upgrade
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)	medium	$ 69,000		$ 69,000			$ -	
Installation of separate access to sanitary sewer chamber	medium	$ 46,000		$ 46,000			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	25%	$ 350	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800		$ 13,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 5,800	100%	$ 5,800	
Fencing repair, replacement or removal				$ -	$ 4,600	50%	$ 2,300	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 12,900			$ 5,450	
Sub-total		**$ 128,800**	**$ -**	**$ 141,700**	**$ 62,500**		**$ 59,950**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 9,500		$ 9,500			$ -	One Time Only
Main Floor Cooling Fan System Upgrades				$ -			$ -	
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	medium		$ 1,400	$ 1,400	$ 2,800	75%	$ 2,100	Every 20 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	high	$ 50,000		$ 50,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	45%	$ 4,050	
Replace Worn Shaft Bearing and/or Universal Joints				$ -	$ 25,000	10%	$ 2,500	
Straighten or Replace Bent Shaft				$ -	$ 25,000	40%	$ 10,000	
Assess Pump Bushing Clearances and Correct				$ -	$ 2,000	100%	$ 2,000	
Lower Shaft Bearing to Clear Shaft Coupling				$ -	$ 5,000	10%	$ 500	
Disassemble Shaft, Relieve Strain and Reinstall				$ -	$ 5,000	10%	$ 500	
Align Misaligned Shaft				$ -	$ 5,000	10%	$ 500	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 900		$ 900	$ 2,600	100%	$ 2,600	Every 10 Years
Vibration Test and Thermal Scan	medium	$ 2,300		$ 2,300	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 10,000	$ 10,000	100%	$ 10,000	
Sub-total		**$ 62,700**	**$ 1,400**	**$ 74,100**	**$ 100,600**		**$ 43,950**	

Table B27.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket	medium		$ 29,000	$ 29,000			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ 2,000	$ 31,000	$ 33,000	$ 16,000		$ 16,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling	low		$ 2,800	$ 2,800			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches	medium	$ 1,700		$ 1,700			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 13,100	$ 13,100			$ -	
Repair drywell floor/swale with new sloped concrete topping	low		$ 10,200	$ 10,200			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 4,400		$ 4,400			$ -	
Discharge box concrete repairs	medium	$ 6,700		$ 6,700			$ -	
Discharge stoplog and guide repairs	medium	$ 11,000		$ 11,000			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 43,500	75%	$ 32,625	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 72,000	75%	$ 54,000	
Install new access platforms for pump shaft guide bearings				$ -			$ -	
Gate chamber concrete repairs	medium	$ 6,600		$ 6,600			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 6,000	$ 6,000			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 2,000		$ 2,000	$ 7,500	75%	$ 5,625	
Upgrade/repair wetwell ladders and railings	high	$ 4,000		$ 4,000			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items	low			$ 7,500			$ 10,000	
Sub-total		$ 38,600	$ 32,100	$ 78,200	$ 126,000		$ 104,500	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 19,800		$ 19,800			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 23,800	$ -	$ 25,000	$ 9,000		$ 9,000	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 352,000		$ 233,400	$ 585,400
Contingency (20%)	$ 70,400		$ 46,680	$ 117,080
Engineering & Administration (20%)	$ 70,400		$ 46,680	$ 117,080
Total Estimated Cost (Excluding PST & GST)	$ 492,800		$ 326,760	$ 819,560

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B28.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	high	$ 33,400		$ 33,400			$ -	2 future replacements
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)	high	$ 2,300		$ 2,300			$ -	Repair roof drain & wall cap sealant joints
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing	low		$ 3,500	$ 3,500	$ 13,800	100%	$ 13,800	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -				
Major aesthetic upgrade (and/or major building repair or alterations)				$ -				
Installation of separate access to sanitary sewer chamber				$ -				
Replace entry door and frame	low		$ 3,500	$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -	$ 1,400	25%	$ 350	
Remove existing window and infill wall opening				$ -				
Create/rework wall openings for ventilation upgrades				$ -				
Minor brick repair and mortar joint repointing	low		$ 3,500	$ 3,500	$ 5,800	50%	$ 2,900	
Wall repair and installation of flashing at discharge block				$ -				
Sealant joint replacement				$ -				
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 11,500		$ 11,500				
Drywell stair safety upgrade (install intermediate rails on landings)				$ -				
Exterior stair safety upgrade (install handrails)				$ -				
Driveway and/or sidewalk repair or replacement				$ -				
Fencing repair, replacement or removal				$ -				
Site regrading				$ -				
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 47,200**	**$ 10,500**	**$ 62,700**	**$ 24,500**		**$ 23,800**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 10,000		$ 10,000			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 11,800		$ 11,800			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to HVC				$ -			$ -	
Replace Existing Seal Water Valving	medium		$ 1,200	$ 1,200	$ 2,400	75%	$ 1,800	Every 20 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	high	$ 22,700		$ 22,700			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	30%	$ 2,700	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 700		$ 700	$ 2,800	100%	$ 2,800	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 7,500	$ 7,500	100%	$ 7,500	
Sub-total		**$ 45,200**	**$ 1,200**	**$ 53,900**	**$ 30,900**		**$ 24,000**	

Table B28.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	To Follow
Install new inclinometers	high	$ 4,500		$ 4,500			$ -	
Monitoring of inclinometers	high	$ 5,000	$ 5,000	$ 10,000			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -	$ 80,000	75%	$ 60,000	
Drainage Improvements				$ -			$ -	
Shear Key				$ -	$ 250,000	50%	$ 125,000	
Additional Unidentified Scope Items				$ -				
Sub-total		$ 11,500	$ 7,000	$ 18,500	$ 346,000		$ 201,000	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 17,700	$ 17,700			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 4,400		$ 4,400			$ -	
Discharge box concrete repairs				$ -			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation	medium	$ 2,200		$ 2,200			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 64,400	75%	$ 48,300	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	medium		$ 89,000	$ 89,000			$ -	
Install new access platforms for pump shaft guide bearings	medium	$ 25,000		$ 25,000			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 1,500	$ 1,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks				$ -	$ 10,000	75%	$ 7,500	
Upgrade/repair wetwell ladders and railings				$ -	$ 2,500	75%	$ 1,875	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -	$ 50,000	75%	$ 37,500	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 10,000			$ 5,000	
Sub-total		$ 31,600	$ 108,200	$ 149,800	$ 129,900		$ 102,425	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade				$ -			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		$ 4,000	$ -	$ 5,200	$ 9,000		$ 9,000	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ 290,100	$ 360,225	$	650,325
Contingency (20%)	$ 58,020	$ 72,045	$	130,065
Engineering & Administration (20%)	$ 58,020	$ 72,045	$	130,065
Total Estimated Cost (Excluding PST & GST)	$ 406,140	$ 504,315	$	910,455

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B29.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	high	$ 11,500		$ 11,500	$ 11,500	100%	$ 11,500	1 future replacement
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing				$ -	$ 27,600	100%	$ 27,600	3 repaintings after upgrade
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)	medium	$ 80,500		$ 80,500			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 13,800		$ 13,800			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)	medium	$ 4,600		$ 4,600			$ -	Drywell landings & interior entry stair handrails
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -	$ 11,500	50%	$ 5,750	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 11,000			$ 5,000	
Sub-total		**$ 110,400**	**$ -**	**$ 121,400**	**$ 59,900**		**$ 54,500**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 9,700		$ 9,700			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 13,900		$ 13,900			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,500		$ 1,500	$ 6,000	75%	$ 4,500	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	high	$ 66,000		$ 66,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -	$ 4,400	75%	$ 3,300	Every 20 Years
Discharge Pipe Replacement				$ -	$ 9,000	60%	$ 5,400	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 900		$ 900	$ 3,600	100%	$ 3,600	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 12,500	$ 12,500	100%	$ 12,500	
Sub-total		**$ 92,000**	**$ -**	**$ 104,500**	**$ 44,700**		**$ 38,500**	

Table B29.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers	high	$ 10,000	$ 10,000	$ 20,000			$ -	
Upgrde existing riprap blanket/install new riprap blanket	medium		$ 78,000	$ 78,000			$ -	
Drainage Improvements				$ -			$ -	
Shear Key	medium		$ 250,000	$ 250,000			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		**$ 12,000**	**$ 340,000**	**$ 352,000**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling	low		$ 2,800	$ 2,800			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 12,000	$ 12,000			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 6,600		$ 6,600			$ -	
Discharge box concrete repairs	medium	$ 7,300		$ 7,300			$ -	
Discharge stoplog and guide repairs	medium	$ 11,000		$ 11,000			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 37,400	75%	$ 28,050	
Replace/Repair slide gate, frame, anchor bolts and/or thimble	very high	$ 50,000		$ 50,000			$ -	Anchor bolts sheared
Install new access platforms for pump shaft guide bearings	medium	$ 9,000		$ 9,000			$ -	
Gate chamber concrete repairs	medium	$ 6,600		$ 6,600			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 4,500	$ 4,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500	$ 5,000	75%	$ 3,750	
Upgrade/repair wetwell ladders and railings	high	$ 3,500		$ 3,500			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 9,000			$ 5,000	
Sub-total		**$ 95,500**	**$ 19,300**	**$ 123,800**	**$ 45,400**		**$ 39,050**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 26,400		$ 26,400			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 30,400**	**$ -**	**$ 31,600**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 733,300**	**$ 157,050**		**$ 890,350**
Contingency (20%)	$ 146,660	$ 31,410		$ 178,070
Engineering & Administration (20%)	$ 146,660	$ 31,410		$ 178,070
Total Estimated Cost (Excluding PST & GST)	**$ 1,026,620**	**$ 219,870**		**$ 1,246,490**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B30.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)	low		$ 12,700	$ 12,700	$ 12,700	100%	$ 12,700	1 future replacement
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)	medium	$ 4,600		$ 4,600			$ -	Upgrade roof perimeter at time of first reroofing
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair	medium	$ 6,000		$ 6,000	$ 5,800	50%	$ 2,900	Install flashing at discharge blocks at same time
Exterior siding and/or trim refinishing	low		$ 16,100	$ 16,100	$ 27,600	100%	$ 27,600	1 refinishing and 3 repainings
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame	low		$ 3,500	$ 3,500	$ 3,500	50%	$ 1,750	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening	low		$ 3,500	$ 3,500			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 11,500		$ 11,500			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 5,800	75%	$ 4,350	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 5,800			$ 5,000	
Sub-total		**$ 22,100**	**$ 35,800**	**$ 63,700**	**$ 55,400**		**$ 54,300**	
Mechanical								
Drywell Ventilation System Upgrades	high	$ 10,000		$ 10,000			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 13,900		$ 13,900			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	high	$ 1,600		$ 1,600	$ 6,400	75%	$ 4,800	Every 10 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts	medium		$ 500	$ 500	$ 500	75%	$ 375	Every 30 Years
Sandblast & Paint Pumps & Piping	high	$ 66,000		$ 66,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	60%	$ 5,400	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft	high	$ 25,000		$ 25,000			$ -	One Time Only
Assess Pump Bushing Clearances and Correct	high	$ 4,000		$ 4,000			$ -	One Time Only
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	high	$ 900		$ 900	$ 3,600	100%	$ 3,600	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 12,500	$ 12,500	100%	$ 12,500	
Sub-total		**$ 121,400**	**$ 500**	**$ 134,400**	**$ 41,200**		**$ 35,875**	

Table B30.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers	high	$ 10,000	$ 10,000	$ 20,000			$ -	
Upgrde existing riprap blanket/instal! new riprap blanket	high	$ 78,000		$ 78,000			$ -	
Drainage Improvements				$ -			$ -	
Shear Key	high	$ 250,000		$ 250,000			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		**$ 340,000**	**$ 12,000**	**$ 352,000**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches	medium	$ 1,700		$ 1,700			$ -	
Inject & patch cracks in dry well concrete walls and or beams	low		$ 14,900	$ 14,900			$ -	
Repair drywell floor/swale with new sloped concrete topping	low		$ 13,000	$ 13,000			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 6,600		$ 6,600			$ -	
Discharge box concrete repairs	medium	$ 5,000		$ 5,000			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 122,700	75%	$ 92,025	Replace or refurbish in 15 to 20 years
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 178,200	75%	$ 133,650	Replace or refurbish in 20 to 30 years
Install new access platforms for pump shaft guide bearings	medium	$ 9,200		$ 9,200			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)	low		$ 7,500	$ 7,500			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -	$ 3,000	75%	$ 2,250	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500	$ 5,000	75%	$ 3,750	
Upgrade/repair wetwell ladders and railings				$ -			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 7,000	
Sub-total		**$ 24,000**	**$ 35,400**	**$ 64,400**	**$ 308,900**		**$ 238,675**	
Electrical								
Upgrade exterior lighting	medium		$ 2,200	$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium		$ 1,800	$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 19,800		$ 19,800			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 19,800**	**$ 4,000**	**$ 25,000**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 639,500**	**$ 353,850**	**$**	**993,350**
Contingency (20%)	$ 127,900	$ 70,770	$	198,670
Engineering & Administration (20%)	$ 127,900	$ 70,770	$	198,670
Total Estimated Cost (Excluding PST & GST)	**$ 895,300**	**$ 495,390**	**$**	**1,390,690**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table B31.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof	medium	$ 34,500		$ 34,500			$ -	
Localized wood frame wall repair				$ -	$ 5,800	50%	$ 2,900	
Exterior siding and/or trim refinishing				$ -	$ 9,200	100%	$ 9,200	Every 10 years
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)	medium	$ 46,000		$ 46,000			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -	$ 3,500	75%	$ 2,625	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell	medium	$ 9,200		$ 9,200			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -	$ 5,800	50%	$ 2,900	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ 9,000			$ 5,000	
Sub-total		**$ 89,700**	**$ -**	**$ 98,700**	**$ 24,300**		**$ 22,625**	
Mechanical								
Drywell Ventilation System Upgrades	medium	$ 6,900		$ 6,900			$ -	One Time Only
Main Floor Cooling Fan System Upgrades	high	$ 10,300		$ 10,300			$ -	One Time Only
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving	medium		$ 1,200	$ 1,200	$ 2,400	75%	$ 1,800	Every 20 Years
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping	medium	$ 34,000		$ 34,000			$ -	One Time Only
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- in to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -	$ 9,000	30%	$ 2,700	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft	high	$ 5,000		$ 5,000			$ -	One Time Only
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes	medium	$ 800		$ 800	$ 3,200	100%	$ 3,200	Every 10 Years
Vibration Test and Thermal Scan				$ -	$ 9,200	100%	$ 9,200	Every 10 Years
Additional Unidentified Scope Items				$ 7,500	$ 7,500	100%	$ 7,500	
Sub-total		**$ 57,000**	**$ 1,200**	**$ 65,700**	**$ 31,300**		**$ 24,400**	

Table B31.1 - Estimated 10 Year & Future Upgrade Costs

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe	high	$ 2,000	$ 2,000	$ 4,000	$ 16,000	100%	$ 16,000	
Install new inclinometers	high	$ 4,500		$ 4,500			$ -	
Monitoring of inclinometers	high	$ 5,000	$ 5,000	$ 10,000			$ -	
Upgrde existing riprap blanket/install new riprap blanket	medium		$ 30,500	$ 30,500			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		**$ 11,500**	**$ 37,500**	**$ 49,000**	**$ 16,000**		**$ 16,000**	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams				$ -	$ 5,700	50%	$ 2,850	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts	medium	$ 2,200		$ 2,200			$ -	
Discharge box concrete repairs	medium	$ 3,300		$ 3,300			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -	$ 17,700	75%	$ 13,275	Replace or refurbish in 25 to 30 years
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -	$ 24,600	75%	$ 18,450	Replace or refurbish in 30 to 35 years
Install new access platforms for pump shaft guide bearings				$ -			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -			$ -	
Inspect & upgrade/repair wetwell trashracks	medium	$ 1,500		$ 1,500			$ -	
Upgrade/repair wetwell ladders and railings				$ -			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ 5,000			$ 5,000	
Sub-total		**$ 7,000**	**$ -**	**$ 12,000**	**$ 48,000**		**$ 39,575**	
Electrical								
Upgrade exterior lighting	medium	$ 2,200		$ 2,200	$ 2,200	100%	$ 2,200	
Upgrade interior lighting	medium	$ 1,800		$ 1,800	$ 1,800	100%	$ 1,800	
Service entrance upgrade	high	$ 13,200		$ 13,200			$ -	
Additional Unidentified Scope Items				$ 1,200	$ 5,000	100%	$ 5,000	
Sub-total		**$ 17,200**	**$ -**	**$ 18,400**	**$ 9,000**		**$ 9,000**	

				Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	**$ 243,800**		**$ 111,600**	**$ 355,400**
Contingency (20%)	$ 48,760		$ 22,320	$ 71,080
Engineering & Administration (20%)	$ 48,760		$ 22,320	$ 71,080
Total Estimated Cost (Excluding PST & GST)	**$ 341,320**		**$ 156,240**	**$ 497,560**

Notes:
All costs are in 2005 dollars
Any applicable provincial and federal taxes are not included in the above estimate

Table 5.33 - Estimated 10 Year & Future Upgrade Costs

NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Building & Site								
Replace membrane roofing, flashing and trim (including hatch)				$ -			$ -	
Replace shingle roofing c/w new underlayment (including hatch)				$ -			$ -	
Roof trim repair or upgrade (including drainage system)				$ -			$ -	
Install new sloped prefinished metal roof & trim over existing flat roof				$ -			$ -	
Localized wood frame wall repair				$ -			$ -	
Exterior siding and/or trim refinishing				$ -			$ -	
Exterior siding and/or trim repair or replace with similar material				$ -			$ -	
Major aesthetic upgrade (and/or major building repair or alterations)				$ -			$ -	
Installation of separate access to sanitary sewer chamber				$ -			$ -	
Replace entry door and frame				$ -			$ -	
Replace interior door and frame				$ -			$ -	
Remove existing window and infill wall opening				$ -			$ -	
Create/rework wall openings for ventilation upgrades				$ -			$ -	
Minor brick repair and mortar joint repointing				$ -			$ -	
Wall repair and installation of flashing at discharge block				$ -			$ -	
Sealant joint replacement				$ -			$ -	
Install thermal barrier over foamed plastic insulation in drywell				$ -			$ -	
Drywell stair safety upgrade (install intermediate rails on landings)				$ -			$ -	
Exterior stair safety upgrade (install handrails)				$ -			$ -	
Driveway and/or sidewalk repair or replacement				$ -			$ -	
Fencing repair, replacement or removal				$ -			$ -	
Site regrading				$ -			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	
Mechanical								
Drywell Ventilation System Upgrades				$ -			$ -	
Main Floor Cooling Fan System Upgrades				$ -			$ -	
Convert Copper and Carbon Steel Shaft Seal Piping to PVC				$ -			$ -	
Replace Existing Seal Water Valving				$ -			$ -	
Replace Flood Pump Pipe Victaulic Coupling and/or Flanged Connection Nuts & Bolts				$ -			$ -	
Sandblast & Paint Pumps & Piping				$ -			$ -	
Bearing Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Hardware Replacement				$ -			$ -	
Packing Gland Cover Replacement				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Tie- In to Pump(s)				$ -			$ -	
Replace Copper Pipe on Shaft Seal Line at Drywell Entry Point				$ -			$ -	
Discharge Pipe Replacement				$ -			$ -	
Replace Worn Shaft Bearing and/or Universal Joints				$ -			$ -	
Straighten or Replace Bent Shaft				$ -			$ -	
Assess Pump Bushing Clearances and Correct				$ -			$ -	
Lower Shaft Bearing to Clear Shaft Coupling				$ -			$ -	
Disassemble Shaft, Relieve Strain and Reinstall				$ -			$ -	
Align Misaligned Shaft				$ -			$ -	
Ultrasonic Testing of all Flood Pump Suction & Discharge Pipes				$ -			$ -	
Vibration Test and Thermal Scan				$ -			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	

Table 5.33 - Estimated 10 Year & Future Upgrade Costs

NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)

Item	0 to 10 Year Upgrade Costs (2005$)				11 to 50 Year Upgrade Costs (2005$) (Future)			Comments
	Priority	0 to 5 Year	6 to 10 Year	10 Year Total Cost	Total Cost	Probability	Pro-rated Costs	
Geotechnical								
Visual inspection of riverbank and outfall pipe				$ -			$ -	
Install new inclinometers				$ -			$ -	
Monitoring of inclinometers				$ -			$ -	
Upgrde existing riprap blanket/install new riprap blanket				$ -			$ -	
Drainage Improvements				$ -			$ -	
Shear Key				$ -			$ -	
Additional Unidentified Scope Items				$ -				
Sub-total		$ -	$ -	$ -	$ -		$ -	
Substructure & Gates								
Repair grade beam cracks and/or spalling				$ -			$ -	
Upgrade/repair drywell stairs/ladders/handrails/hatches				$ -			$ -	
Inject & patch cracks in dry well concrete walls and or beams				$ -			$ -	
Repair drywell floor/swale with new sloped concrete topping				$ -			$ -	
Repair spalled pump base concrete, grout and/or anchor bolts				$ -			$ -	
Discharge box concrete repairs				$ -			$ -	
Discharge stoplog and guide repairs				$ -			$ -	
Add vents to discharge box to reduce condensation				$ -			$ -	
Replace/Repair flap gate, frame, anchor bolts and/or thimble				$ -			$ -	
Replace/Repair slide gate, frame, anchor bolts and/or thimble				$ -			$ -	
Install new access platforms for pump shaft guide bearings				$ -			$ -	
Gate chamber concrete repairs				$ -			$ -	
Repair wetwell roof, wall and column concrete (cracks and or spalling)				$ -			$ -	
Repair wetwell intermediate slab and beam, floor slab and culvert (cracks and or spalling)				$ -			$ -	
Inspect & upgrade/repair wetwell trashracks				$ -			$ -	
Upgrade/repair wetwell ladders and railings				$ -			$ -	
Upgrade/repair wetwell slide gate shafts and shaft supports				$ -			$ -	
Clean wetwell floor				$ -			$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	
Electrical								
Upgrade exterior lighting				$ -			$ -	
Upgrade interior lighting				$ -			$ -	
Service entrance upgrade							$ -	
Additional Unidentified Scope Items				$ -			$ -	
Sub-total		$ -	$ -	$ -	$ -		$ -	

			Grand Total (10 Year & Future)
Total Estimated Upgrade Costs (Excluding PST & GST)	$ -	$ -	$ -
Contingency (20%)	$ -	$ -	$ -
Engineering & Administration (20%)	$ -	$ -	$ -
Total Estimated Cost (Excluding PST & GST)	$ -	$ -	$ -

City of Winnipeg Flood Pump Station Condition Assessment
Summary Report - Very High & High Upgrade Costs

Table 5.34 - Estimated Very High & High Upgrade Costs

Station	Number of High/Very High Priority Items	Estimated High & Very High Priority Items Upgrade Costs	Comments
Ash	7	$ 64,900.00	
Assiniboine	5	$ 23,850.00	
Aubrey	6	$ 76,100.00	
Baltimore	7	$ 110,400.00	
Bannatyne	3	$ 30,400.00	
Clifton	4	$ 60,400.00	
Cockburn	7	$ 81,800.00	
Colony	6	$ 354,500.00	
Cornish	5	$ 63,500.00	
Despins	9	$ 404,500.00	
Dumoulin	6	$ 69,000.00	
Galt	6	$ 36,500.00	
Hart	7	$ 90,500.00	
Hawthorne	1	$ 32,100.00	
Jefferson	7	$ 116,300.00	
Jessie	5	$ 62,400.00	
Larchdale			NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)
La Verendrye	7	$ 24,550.00	
Linden	7	$ 120,950.00	
Magor	5	$ 53,450.00	
Marion	11	$ 415,500.00	
Mayfair	3	$ 6,400.00	
Metcalfe	7	$ 68,300.00	
Mission	7	$ 79,200.00	
Munroe			NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)
Newton	6	$ 62,000.00	
Poison	4	$ 75,800.00	
Roland	7	$ 81,700.00	
Selkirk	9	$ 183,500.00	
St. John's	12	$ 481,200.00	
Syndicate	6	$ 40,000.00	
Ravelston			NOTE: STATION WAS REMOVED FROM SCOPE OF WORK (NOT A TYPICAL FLOOD PUMPING STATION)
Total All Stations	182		
Total Estimated High & Very High Upgrade Costs (Excluding PST & GST)		**$ 3,369,700.00**	
Contingency (20%)		$ 673,940.00	
Engineering & Administration (20%)		$ 673,940.00	
Total Estimated Cost (Excluding PST & GST)		**$ 4,717,580.00**	

DRAWINGS

APPENDICES

APPENDICES

APPENDIX A

REFERENCES

APPENDIX A1

REFERENCE REPORTS

APPENDIX A1
REFERENCE REPORTS

56th Canadian Geotechnical Conference 2003, Darren Yarechewski, UMA Engineering and Jeff Tallin, UMA Engineering, *Riverbank Stabilization Performance with Rock-Filled Ribs/Shear Key and Columns.*

A. Dean Gould ITL, 1980, *Appendix 3 Report on Riverbank Stability at the Proposed Outfall in St. John's Park for the St. John's/Polsor Sewer Relief Project Phase 1.*

A. Dean Gould, P.Eng., January 1988, *Report on Riverbank Stability Analysis Newton Avenue Outfall.*

Baracos and Marantz, December 1956, *Soil Mechanics Investigation Proposed Ash Street Pumping Station.*

City of Winnipeg – Works & Operations Division, 1986, *Basement Flooding Relief Program Review.*

City of Winnipeg, 1989, *City of Winnipeg Instruction Manual of Operations for Flood pumping Station (Orange Book).*

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Dyregrov & Burgess, August 1986, *Geotechnical Report Cockburn Flood & Wastewater Power Station.*

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Hardy BBT Limited, October 1991, *Riverbank Pathway Between Mostyn Park & Cornish Avenue Getoechnical Feasibility Study.*

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KGS Group Letter/Report, September 16, 2004, *Proposed Transformer Installation Aubrey Street FPS Geotechnical Investigation and Riverbank Stability Assessment.*

KGS Group Report, December 2003, *2003 Outfall Maintenance Program Dumoulin Outfall RR-58 Geotechnical Evaluation.*

KGS Group, 2002, *City of Winnipeg* Flood Manual "Flood Pump Station Overview Report" (Appendix E) and data Sheets included in Appendix F.

- Flood Pump Stations – Metric Geodetic – Baseline Data – Control Elevations
- Flood Pump Stations – Metric Geodetic – Baseline Data – Station Elevations
- Flood Pump Stations – Metric Geodetic – Baseline Data – Pumps
- Flood Pump Stations – Metric Geodetic – Baseline Data – Outfall & Miscellaneous

KGS Group, Report, December 2004, *Granite Curling Club Riverbank Stability Evaluation.*

KGS Group, Report, June 29, 1990, *Jessie FPS Riverbank Stability Study* and KGS Group, Report, October 1991, *Functional Design Report.*

Templeton Engineering Company, March 1975, *Riverbank Stability Study at the Proposed Hawthorne Outfall Replacement*

UMA Engineering, December 1980, *Geotechnical Evaluation for Slope Stabilization at Majer Drive.*

UMA Engineering, December 1995, *Geotechnical Investigation for North West District Outfall Restriction St. John's Avenue Outfall.*

UMA Engineering, February 1986, *Report on Proposed Outfall Repairs at Cornish Avenue & Clifton Avenue Sites.*

UMA Engineering, January 1989, *Report on Geotechnical Investigations for the Polson Avenue and Armstrong Avenue Outfalls.*

UMA Engineering, March 1991, *Geotechnical Investigation for the Syndicate Street Outfall.*

UMA Engineering, March 1991, *Geotechnical Investigations for Selkirk Avenue Outfall.*

UMA Engineering, May 1990, *City of Winnipeg Waterworks,Waste and Disposal Department Lyndale Drive Slope Stability Study.*

UMA Engineering, September 1990, *Mager Drive Pumping Station Preliminary Slope Stability Investigation.*

UMA Letter Report, January 30, 1992, Selkirk FPS

UMA Letter Report, July 25, 1991, Selkirk FPS

UMA, January 1993, *Jefferson Avenue Outfall*

APPENDIX A2

REFERENCE DRAWINGS

CITY OF WINNIPEG
FLOOD MANUAL ISOMETRIC DRAWINGS

APPENDIX A2
LIST OF CITY OF WINNIPEG FLOOD MANUAL ISOMETRIC DRAWINGS

1. Ash FPS
2. Assiniboine FPS
3. Aubrey FPS
4. Baltimore FPS
5. Bannatyne FPS
6. Clifton FPS
7. Cockburn FPS
8. Colony FPS
9. Cornish FPS
10. Despins FPS
11. Dumoulin FPS
12. Galt FPS
13. Hart FPS
14. Hawthorne FPS
15. Jefferson FPS
16. Jessie FPS
17. Larchdale SFPS – Station was removed from scope of work (not a typical flood pumping station)
18. LaVerendry FPS
19. Linden FPS
20. Mager FPS
21. Marion FPS
22. Mayfair FPS
23. Metcalfe FPS
24. Mission FPS
25. Munroe FPS - Station was removed from scope of work (not a typical flood pumping station)
26. Newton FPS
27. Polson FPS
28. Roland
29. Selkirk FPS
30. St. Johns FPS
31. Syndicate FPS
32. Transcona – Ravelston – Station was removed from scope of work (not a typical flood pumping station)

P:\Projects\2004\04-0107-12\Admin\AdminDocs\Reports\FPS Condition Assessment - FinalReport\Main Report\Appendix A - References\Appendix A2 - Isometric Drawings.doc

FLOOD PUMPING STATION REFERENCE DRAWINGS

City of Winnipeg, Water & Waste Department

Flood Pump Station Condition Assessment

Reference Drawing List - September 2005 - Rev4

(KGS has a copy of yellow highlighted drawings)

Author	Title	Year	Drawing #
	ASH		
City of Winnipeg, Waterworks, Waste and Disposal Department	Ash Street - Proposed Location of Flood Pumping Station	1952	R-197, File #FP10216
City of Winnipeg Engineering Department	Ash Street Flood Gate	1954	684 - 1
City of Winnipeg Engineering Department	Ash Street Flood Pumping Station Locations Plan & Details	1954	684 - 3, File #FP10180
City of Winnipeg, Engineering Department	Ash Street Flood Pumping Station - Sections	1954	684 - 4, File #FP10181
City of Winnipeg, Engineering Department	Ash Street Flood Pumping Station - Sections & Details	1954	684 - 5, File #FP10182
City of Winnipeg, Engineering Department	Ash Street Flood Pumping Station - Details	1954	684 - 6, File #FP10183
City of Winnipeg, Engineering Department	Ash Street Flood Pumping Station - Location and Plans	1954	R- 121
City of Winnipeg, Engineering Department	Ash Street - Site Plan and Easement Proposed Flood Pumping Station	1957	R210, File #FP10228
City of Winnipeg, Engineering Department	Ash Street Flood Pumping Station Superstructure - Floor and Roof Plans	1957	R 211, File #10229
City of Winnipeg, Engineering Department	Ash Street Flood Pumping Station Superstructure - Elevations - Details - Sections	1957	R 212, File #10231
City of Winnipeg, Waterworks, Waste and Disposal Department	Ash Street Flood Pumping Station - Plot Plan - Outfall - Sewer Relocation & Inlet Flume	1957	R198, File #FP10217
City of Winnipeg, Waterworks, Waste and Disposal Department	Ash Street Flood Pumping Station - Outfall - Site Plan - Intake	1957	R198A, File #FP10218
City of Winnipeg, Waterworks, Waste and Disposal Department	Ash Street - Flood Pumping Station - Re-design Inlet Opening to Station	1958	R198B
City of Winnipeg, Waterworks, Waste and Disposal Department	Ash Street Flood Pumping Station Floor Plans & Sections	1958	R199, File #FP10220
The Metropolitan Corporation of Greater Winnipeg Waterworks & Waste Disposal Division	Ash Street Pumping Station - Alterations	1962	407
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Ash District - Sewer Relief Contact IV A - Outfall & Connection Details - Standard Detail	1980	LD - 439
The City of Winnipeg, Works and Operations Division, Water and Waste Dept.	Ash Flood Station-Electrical and Controls	1997	97-FS-Q-2
The City of Winnipeg, Water and Waste Department	Ash Gate Chamber - Demolition Drawing and Site Plan Sheet 1 of 4	2000	LD - 2198
The City of Winnipeg, Water and Waste Department	Ash Gate Chamber - Plan and Details Sheet 2 of 4	2000	LD - 2199
The City of Winnipeg, Water and Waste Department	Ash Gate Chamber - Reinforcing Details Sheet 3 of 4	2000	LD - 2200
The City of Winnipeg, Water and Waste Department	Ash Gate Chamber - Miscellaneous Metal Details Sheet 4 of 4	2000	LD - 2201
City of Winnipeg, Waterworks, Waste and Disposal Department	Ash Street Flood Pumping Station - Sections		R-200, File #FP10223
City of Winnipeg, Engineering Department	Ash, Cornish Gate Chambers - Parkville Control Structure Drawings, Chataway Gate Chamber		
	ASSINIBOINE		
Greater Winnipeg Dyking Board	Assiniboine Ave. Pumping Station - Supplementary Drawing	1951	5-SD-3C
City of Winnipeg, Works and Operations Division Waterworks Waste and Disposal Department	Assiniboine Flood Station Automatic Level Control and Alarm System- Wiring Diagram and Panel Layout	1990	6-FS-Q-1
City of Winnipeg, Works and Operations Div Street and Transportation Department	Assiniboine River Outfall - Site Plan and Details Sheet 5 of 9	1995	LD-1773
City of Winnipeg, Works and Operations Div Street and Transportation Department	Assiniboine River Gate Chamber and Standard Details Sheet 6 of 9	1995	LD-1774
City of Winnipeg, Works and Operations Div Street and Transportation Department	Assiniboine River Gate Chamber - Reinforcing Details Sheet 7 of 9	1995	LD-1775
City of Winnipeg, Works and Operations Div Street and Transportation Department	Assiniboine River - Roof Hatch and Miscellaneous Metal Details Sheet 8 of 9	1995	LD-1776

Author	Title	Year	Drawing #
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Location Profile, Details	1955	R136
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Inlet Flume - Discharge Pipe & Site Plan	1956	R-187, File #FP10204
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station Transformer Pad	1956	R188, File #FP10206
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey St. Flood Pumping Station - Sheet 1	1956	R-189, File #FP10207
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Sections (Sheet 2)	1956	R-190, File #FP10208
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Detail Sheet #1	1956	R-191, File #FP10209
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Detail Sheet #2	1956	R-192, File #FP10210
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Detail Sheet #3	1956	R-193, File #FP10211
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Detail Sheet #4	1956	R-194, File #FP10212
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Motor Mounting & Beam Revisions	1957	R-194A, File #FP10213
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Detail Sheet #5	1959	R217, File #FP10236
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Flood Station Automatic Level Control and Alarm System - Wiring Diagram and Panel Layout		8-FS-Q-1
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station Superstructure		F196
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Electrical		R-145
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station - Sections (Sheet 1)		R-185
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey St. Flood Pumping Station - Excavation Plan for Stabilizing River Bend		R-187A
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey Street Flood Pumping Station Details - Sheet 2		R198
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Aubrey St. Flood Pumping Station for 12' Driveway		R-218
	BALTIMORE		
Greater Winnipeg Dyking Board	Baltimore Road & Metcalfe Road Pumping Stations - Electrical Layout	1951	5-E-5
Greater Winnipeg Dyking Board	Baltimore Road Pumping Station Sheet 1 of 2	1951	5-SD-2-1 #SP10547
Greater Winnipeg Dyking Board	Baltimore Road Pumping Station Sheet 2 of 2	1951	5-SD-2-2 #SP10548
City of Winnipeg Works and Operations Division	Baltimore Flood Station-Automatic Level Control Schematic Diagram & Alarm Panel Layout	1987	9-FS-Q-1
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Baltimore Station Gate Installation Arrangement and Concrete Outlines	1988	LD-899, File #10401
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Department	Baltimore, La Verendrye & Mager Flood Pumping Stations / Baltimore Station Gate Installation Arrangement and Concrete Outlines	1988	LD - 899
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Baltimore, La Verendrye & Mager Flood Pumping Stations / Miscellaneous Metal	1988	LD - 902
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Baltimore Station Gate Installation - Reinforcing Steel	1988	LD-900, File #10364
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The City of Winnipeg, Works and Operations Division	Bannatyne Flood Station-Automatic Level Control Schematic Diagram & Alarm Panel Layout	1987	10-FS-Q-1
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Bannatyne Flood Pumping Station - Gate Chamber Site plan	1996	LD - 1545
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Bannatyne Flood Pumping Station - Gate Chamber	1996	LD - 1546
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Bannatyne Flood Pumping Station - Access Hatch and Ladder Details	1996	LD - 1547
	CLIFTON		
City of Winnipeg, Waterworks, Waste and Disposal Department	Clifton Street Flood Pumping Station - Floor Plans & Details	1960	R228-F, File #10248
City of Winnipeg, Waterworks, Waste and Disposal Department	Clifton Street Flood Pumping Station - Pump layout details	1960	R228-A, #PF10241
City of Winnipeg, Waterworks, Waste and Disposal Department	Clifton Street Flood Pumping Station - Outfall & Site Plan	1960	R228-B, File #10070
City of Winnipeg, Waterworks, Waste and Disposal Department	Clifton Street Pumping Station - Superstructure - Plans & Elevations	1960	R228-C, File #FP10243
City of Winnipeg, Waterworks, Waste and Disposal Department	Clifton Street Pumping Station - Plot Plan	1960	R-228-E, File #FP10246
City of Winnipeg, Waterworks, Waste and Disposal Department	Clifton Street Pumping Station - Substructure Sections	1960	R228-G, File #FP 10249
City of Winnipeg, Waterworks, Waste and Disposal Department	Clifton Street Pumping Station - Proposed Gate	1961	R228 E1
City of Winnipeg, Waterworks, Waste and Disposal Department	Clifton Street Pumping Station - Superstructure	1962	416
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City of Winnipeg, Waterworks, Waste and Disposal Department	Clifton St. Pumping Station	1964	203A
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Clifton Combined Sewer Relief Project / Clifton Gate Chamber Alterations - Sheet 1	1979	LD - 194, File #GC10057
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Clifton Combined Sewer Relief Project / Clifton Gate Chamber Alterations - Sheet 2	1979	LD - 195
The City of Winnipeg, Works and Operations Division, Operations Department - District 1	Clifton Street Outfall Proposed upgrading Site Plan, Profile and Details	1986	LD - 570, File #LD1599
The City of Winnipeg, Water and Waste Department	Clifton Street Outfall Repairs (AS - 74) S. of Wolseley Ave. Rue La Verendrye Outfall (RR - 60) N. of Tache Ave.	1999	LD - 1950
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City of Winnipeg, Waterworks, Waste and Disposal Department	Cockburn Street Flood Pumping Station - Details	1954	R-139, #FP10017
City of Winnipeg, Waterworks, Waste and Disposal Department	Cockburn Street Flood Pumping Station - Details	1954	R-140, #FP10018
City of Winnipeg, Waterworks, Waste and Disposal Department	Cockburn Street Flood Pumping Station - Comminutor, Sump & Sewage Pumping Station for G.W.S.D.	1954	R-141, #FP10019

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City of Winnipeg, Waterworks, Waste and Disposal Department	Cockburn Street Flood Pumping Station - Superstructure	1954	R-143
City of Winnipeg, Waterworks, Waste and Disposal Department	Cockburn Street Flood Pumping Station - Pump Alteration Data	1954	R-144, #FP10010
City of Winnipeg, Waterworks, Waste and Disposal Department	Cockburn Street Flood Pumping Station - 20" Pump Installation	1954	R-145, #FP10011
City of Winnipeg, Waterworks, Waste and Disposal Department	Cockburn Street Flood Pumping Station - Location Profile & Details	1955	R-137, #FP10015
Greater Winnipeg Sanitary District	Cockburn Forcemain - Connection to G.W.S.D. Pumping Station	1957	#FM10022
City of Winnipeg, Waterworks, Waste and Disposal Department	Cockburn Street Sewer Outfall - Renewal	1965	R-239, File #FP10268
The City of Winnipeg, Works and Operations Division	Cockburn Flood Station-Automatic Level Control Schematic Diagram & Alarm Panel Layout	1984	19-FS-Q-1
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Cockburn St. Pumping Station Slope Stabilization and Outfall Remedial Works / Existing General Arrangement & Items of Work	1988	LD - 929, File #10298
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Cockburn St. Pumping Station Slope Stabilization and Outfall Remedial Works / High Level Discharge Pipe Sections & Details	1988	LD - 931, File #LD10300
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Cockburn St. Pumping Station Slope Stabilization and Outfall Remedial Works / Modifications to Existing Gate Chamber & Low Level Outfall	1988	LD - 932, File #LD10301
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Cockburn St. Pumping Station Slope Stabilization and Outfall Remedial Works / Gate Chamber Modifications & Details	1988	LD - 933, File #LD10302
	COLONY		
Greater Winnipeg Sanitary District	Colony - Alternative Method of Constructing Slab (Superstructure)	1951	#CS10007
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Colony Street Flood Pumping Station - Location Plan & Details	1953	R-71
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Colony Street Flood Pumping Station - Superstructure	1953	R-72
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Colony Street Flood Pumping Station - Lighting, Water San. Feed, Transformer Platform, Ventilation Fan, Piping Details	1953	R-73
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Colony Street Flood Pumping Station Reinforcing	1953	R-74
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City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Colony Street Flood Pumping Station - Electrical	1953	R-76
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City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Colony Street Flood Pumping Station - Plot - Plan	1959	R-4, #FP10238
City of Winnipeg, Waterworks, Waste and Disposal Department	Colony Street Sewer Outfall - Reconstruction	1971	SC - 15781
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Colony Flood Pumping Station Automatic Level Control and Alarm System - Wiring Diagram and Panel Layout	1989	20-FS-Q-1, #FP10018
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Colony District Combined Sewer Relief - Spence Street Gate Chamber Proposed Addition - Site Plan	1995	LD - 1532
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Colony District Combined Sewer Relief - Spence Street Gate Chamber Proposed Addition Demolition Details of Existing Gate Chambers	1995	LD - 1533
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Colony District Combined Sewer Relief - Spence Street Gate Chamber Proposed Addition Outfall Details	1995	LD - 1537
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Colony District Combined Sewer Relief - Colony Street Pumphouse Proposed Addition - Site Plan	1995	LD - 1538
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Colony District Combined Sewer Relief - Colony Street Pumphouse Proposed Addition Existing Pumphouse	1995	LD - 1539
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Greater Winnipeg Sanitary District	Cornish - Flood Gate and Weir	1953	R-75
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Cornish Avenue Sewer - Gate Chamber	1953	R-79
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City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Cornish Avenue Flood Pumping Station - Alternative Concrete Sections	1953	R-86
City of Winnipeg, Engineering Department	Cornish Avenue Flood Pumping Station - Gates for Suction Inlets	1954	R-89, 680Z
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Cornish Avenue Flood Pumping Station - Installation 3000 gpm pump	1954	R-90
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Cornish Avenue Flood Pumping Station - 20" Pump Installation	1954	R-91
City of Winnipeg, Engineering Department	Cornish Avenue Flood Pumping Station - Details	1954	
The City of Winnipeg, Works and Operations Division, Operations Department - District 1	Cornish Avenue Outfall Proposed Upgrading Site Plan, Profile Details	1986	LD - 569
The City of Winnipeg, Water and Waste Department	Cornish Gate Chamber - Demolition Drawing and Site Plan Sheet 1 o 4	2000	LD - 2208
The City of Winnipeg, Water and Waste Department	Cornish Gate Chamber - Plan and Details Sheet 2 of 4	2000	LD - 2209
The City of Winnipeg, Water and Waste Department	Cornish Gate Chamber - Reinforcing Details Sheet 3 of 4	2000	LD - 2210
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Greater Winnipeg Dyking Board	Despins Pumping Station	1951	2 -SD - 2, #SP10226
Greater Winnipeg Dyking Board	Despins Pumping Station	1951	2 -SD - 2, #FP10062
Greater Winnipeg Dyking Board	Despins and Mission St. Pumping Stations - Electrical Layout	1951	2-E-1
Greater Winnipeg Sanitary District	Despins Secondary Sewer (St. Boniface) - Flood Protection Valve	1951	S 106
Greater Winnipeg Dyking Board	Despins St. Flood Pump Station (St. Boniface) - Sewage Screens	1952	M - 179
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Despins St. & Norwood Br Stations - Detail of Sump & Control Gates	1956	S-12
City of St Boniface Public Works Department	Despins St. & Norwood Br. Stations - Detail of Sump & Control Gate	1958	S - 12
The Metropolitan Corporation of Greater Winnipeg Waterworks & Waste Disposal Division - Waste Disposal Branch	Despins - Reloc of Secondary at Marion St. Pumping Sta. (not constructed) - Plan - Manhole & Sump Conn	1962	409
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The Metropolitan Corporation of Greater Winnipeg Waterworks & Waste Disposal Division - Waste Disposal Branch	Despins Pumping Station - Alteration	1964	502
City of Winnipeg, Works and Operations Division, Waterworks Waste and Disposal Department	Despins Flood Station Automatic Level Control Schematic Diagram and Alarm Panel Layout	1980	27-FS-Q-1
The City of Winnipeg, Works and Operations Division	Despin Pumping Station - Location Plan	1986	1177/1177a
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Despins Pumping Station (Electrical Upgrading)	1987	1205
The City of Winnipeg, Works and Operations Division	Despin Pumping Station Upgrading (Mechanical)	1987	1216
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City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Despins Gate Chamber Upgrading	1989	LD-997
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City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Despins Pumping Station - Alterations		502
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Greater Winnipeg Dyking Board	Dumoulin Ave. Pumping Station	1951	2-SD-8-1, File #FP10069
Greater Winnipeg Dyking Board	Dumoulin Ave. Pumping Station	1951	2-SD-8-2, File #FP10070
Greater Winnipeg Sanitary District	Dumoulin Flood Pumping Station (St. Boniface) - Temporary Sewage Screen for 30" Pump	1952	M 160, File #FP10286
Greater Winnipeg Sanitary District	Dumoulin Flood Pumping Station (St. Boniface) - Temporary Sewage Screen for 20" Pump	1952	M 161, File #FP10287
Greater Winnipeg Sanitary District	Dumoulin, Mission & Newton Stations - Preliminary Screen Dimensions	1955	M - 200, File #FP10296
Greater Winnipeg Sanitary District	Dumoulin and La Verendrye Secondaries in St. Boniface	1956	246, #SS10068
Greater Winnipeg Sanitary District	Dumoulin Comminutor & Pumping Station Layout	1956	251, #CS10002
Greater Winnipeg Sanitary District	Dumoulin Comminutor & Pumping Station Details	1956	252, #SP10046
Greater Winnipeg Sanitary District	Dumoulin Comminutor & Pumping Station Plans Steel Reinforcing Details	1956	253, #SP10047
Greater Winnipeg Sanitary District	Dumoulin Comminutor & Pumping Station Elev.. Steel Reinforcing Details	1956	254, #SP10048
W.L Wardrop & Associates	Dumoulin Street Pumping Station - Structural Details of Gate Chamber and 42" Flap Gate	1957	S - 27, File #SP10414
City of Winnipeg, Waterworks, Waste and Disposal Department	Dumoulin Comminutor and Pumping Station	1981	251A, #SP10045
The City of Winnipeg, Works and Operations Division - Operations Department - District 6	Dumoulin Outfall Riverbank Stabilization	1989	H.F.1082
The City of Winnipeg, Works and Operations Division - Operations Department - District 5	Dumoulin Outfall Riverbank Stabilization Miscellaneous Details	1989	H.F.1083
City of Winnipeg, Works and Operations Division, Waterworks Waste and Disposal Department	Dumoulin Flood Station Automatic Level Control and Alarm System Wiring Diagram and Panel Layout	1993	29-FS-Q-1
City of Winnipeg Water and Waste Dept.	Dumoulin Flood Pumping Station - Gate Chamber Plan and Profiles Sheet 1 of 5	2002	LD-2682
City of Winnipeg Water and Waste Dept.	Dumoulin Flood Pumping Station - Misc Metal Details Sheet 2 of 5	2002	LD-2683
City of Winnipeg Water and Waste Dept.	Dumoulin Flood Pumping Station - Reinforcing Detail Sheet 3 of 5	2002	LD-2684
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The City of Winnipeg, Water and Waste Department	Dumoulin / La Verendrye Combined Sewer Relief Project Contract No. 2 - Rue Messager 900 mm outfall	2002	
	GALT		
Greater Winnipeg Dyking Board	Galt Avenue Pumping Station	1951	5-SD-16, File #SP10566
City of Winnipeg Works and Operations Division	Galt Flood Station-Automatic Level Control & Alarm System, Wiring Diagram & Panel Layout	1985	32-FS-Q-1
	HART		
Greater Winnipeg Dyking Board	Hart Ave Pumping Station	1951	5-SD-8-1, File #SP10560
Greater Winnipeg Dyking Board	Hart Ave Pumping Station	1951	5-SD-8-2, File #SP10561
City of Winnipeg Works and Operations Division	Hart Flood Station-Automatic Level Control & Alarm System, Wiring Diagram & Panel Layout	1985	34-FS-Q-1
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Hart, Munroe & Roland Sewer Relief Project / Pumping Station to Gate Chamber - Connecting Piping and Details	1985	D4 - 918
City of Winnipeg, Waterworks, Waste and Disposal Department	Hart Wastewater Pumping Station Upgrading	1989	1286, File #SP10384
City of Winnipeg, Waterworks, Waste and Disposal Department	Hart Wastewater Pumping Station Upgrading Geotechnical Investigation	1989	1277, File #10380

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City of Winnipeg, Waterworks, Waste and Disposal Department	Hart Wastewater Pumping Station Upgrading - Site Plans and Details	1989	1284, File #SP10382
City of Winnipeg, Waterworks, Waste and Disposal Department	Hart Wastewater Pumping Station Upgrading Sections	1989	1285, File #SP10383
The City of Winnipeg, Works & Operations Division	Hart Wastewater Pumping Station Upgrading - Geotechnical Investigation	1989	DRAWINGS 2x3 Xerox copy
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The City of Winnipeg, Works and Operations Division, Water and Waste Department	Hart Flood Pumping Station - Plan Details	1997	LD - 1721
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Hart Flood Pumping Station - Reinforceing Details & Miscellaneous Metal	1997	LD - 1722
Greater Winnipeg Dyking Board	Hart Ave. & Mager Drive Pumping Stations - Electrical Layout		1-E-1
	HAWTHORNE		
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The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Hawthorne Pumping Station Pump Replacement	1978	959
	JEFFERSON		
	Jefferson Electrical Revisions	1950	4-F-1
Greater Winnipeg Dyking Board	Jefferson Ave. Pumping Station Electrical Layout	1951	4-E-1-1 & 4-E-1-2
Greater Winnipeg Dyking Board	Jefferson Avenue Pumping Station	1951	4-SD-1-1
Greater Winnipeg Dyking Board	Jefferson Avenue Pumping Station	1951	4-SD-1-2
Greater Winnipeg Dyking Board	Jefferson Avenue Pumping Station	1951	4-SD-1-3
Greater Winnipeg Dyking Board	Jefferson Ave. Pumping Station for Transformers and Starters - Extension	1951	4-SD-1-4
Greater Winnipeg Sanitary District	Jefferson Avenue Flood Pump Station - West Kildonan - Sewage Screens	1952	M 185
Greater Winnipeg Sanitary District	Jefferson - Main St. Comminutor Station Reinforcing Steel Design	1957	291
Greater Winnipeg Sanitary District	Jefferson - Main Comminutor Station	1957	R290
Greater Winnipeg Sanitary District	Jefferson - Main Comminutor Station	1957	R290A
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Jefferson Flood Station Automatic Level Control & Alarm System Wiring Diagram & Panel Layout	1983	40-FS-Q-1
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Jefferson Flood Pumping Station Gate Chamber Section Details	1993	LD - 1208
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Jefferson Flood Pumping Station Gate Chamber Reinforcing Details	1993	LD - 1209
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Jefferson Ave. - 1993 Outfall Reconstruction (Sections and Details)	1993	LD-1263
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Jefferson Ave. - 1993 Outfall Reconstruction (Sections and Details)	1993	LD-1264
The City of Winnipeg, Works and Operations Division - Operations Dept. - North West District	Jefferson Avenue - 1993 Outfall Reconstruction - Site Plan	1994	4282
The City of Winnipeg, Works and Operations Division - Operations Dept. - North West District	Jefferson Avenue - 1994 Outfall Reconstruction - Sections and Details	1994	4283
The City of Winnipeg, Works and Operations Division - Operations Dept. - North West District	Jefferson Avenue - 1995 Outfall Reconstruction - Proposed Outfall Works	1994	4284
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Jefferson Flood Pumping Station Site Plan and Weir Details	1996	LD - 1207
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City of Winnipeg, Engineering Department	Jessie Avenue Flood Pumping Station - Sections	1954	683 - 4, File #FP10169
City of Winnipeg, Engineering Department	Jessie Avenue Flood Pumping Station - Details	1954	683 - 5, File #FP10170
City of Winnipeg, Engineering Department	Jessie Avenue Flood Pumping Station - Plans and Elevations	1954	683-8, File #FP10173
City of Winnipeg, Engineering Department	Jessie Avenue Flood Pumping Station - 3000 GPM Pump Installation	1955	683 -7, File #FP10172
Greater Winnipeg Sanitary District	Jessie Ave. Comminutor Station Addition - Details	1955	285
Greater Winnipeg Sanitary District	Jessie Ave. Comminutor Sta. - Details of Comm. Well Cover & New Weir in Flood Pumping Station	1955	286
Greater Winnipeg Sanitary District	Jessie Ave. Station - Reinforcing Detail	1956	287
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City of Winnipeg, Waterworks, Waste and Disposal Department	Jessie Ave. Wastewater/Flood Pumping Station - Riverbank Stabilization - Outfall Plan & Profile	1991	LD 1126, File #LD 10398
The City of Winnipeg, Waterworks, Waste and Disposal Department	Jessie Avenue Wastewater/Flood Pumping Station - Riverbank Stabilization - Manhole Details	1991	LD 1127, File #FP10399
City of Winnipeg Works and Operations Division Water and Waste Department	Jessie Flood Station-Electrical and Control	1997	97-FS-Q-3
The City of Winnipeg, Waterworks, Waste and Disposal Department	Jessie Avenue Flood Pumping Station - Plans and Details	1998	LD -1861
The City of Winnipeg, Waterworks, Waste and Disposal Department	Jessie Avenue Flood Pumping Station - Gate Chamber Reinforcing Details	1998	LD - 1862
The City of Winnipeg, Waterworks, Waste and Disposal Department	Jessie Avenue Flood Pumping Station - Outfall	-	1318, File #FP10009
	LA VERENDRYE		
Greater Winnipeg Dyking Board	La Verendrye Pumping Station	1950	2 - SD - 1
W.L Wardrop & Associates	La Verendrye Pump House - Proposed Sluice Gate	1959	S -53
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	La Verendrye Flood Station Automatic Level Control Schematic Diagram & Alarm Panel Layout	1984	48-FS-Q-1
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	La Verendrye Flood Station Automatic Level Control Schematic Diagram & Alarm Panel Layout	1984	48-FS-Q-1A
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Department	La Verendrye, Baltimore and Mager Flood Pumping Stations / La Verendrye Flood Pumping Station Gate Installation	1988	LD - 901
	LARCHDALE		
The City of Winnipeg, Waterworks, Waste and Disposal Division	Larchdale Pump Station and Site Plan	1978	WW-15-284, File #LD10190
The City of Winnipeg, Waterworks, Waste and Disposal Division	Larchdale Pump Station Floor Plans and Sections	1978	WW-16-284, File #LD10191
The City of Winnipeg, Waterworks, Waste and Disposal Division	Larchdale Pump Station - Sections & Details	1978	WW-17-284, File #LD10192
The City of Winnipeg, Waterworks, Waste and Disposal Division	Larchdale Pump Station Structural Sections and Details	1978	WW-18-284, File #LD10193
The City of Winnipeg, Waterworks, Waste and Disposal Division	Larchdale Pump Station - Miscellaneous Sections and Details	1978	WW-19-284, File #LD10194
	Larchdale/Rowandale LOS Outfall & Catchment LBIS Maps & As Builts, and Additional Drawings		
	LINDEN		
Greater Winnipeg Dyking Board	Linden & Dumoulin Pumping Stations	1951	2.00E+03
Greater Winnipeg Dyking Board	Linden Avenue Pumping Station	1951	3-SD-2-1, SD-2-2 & 2-SD-2-1
Greater Winnipeg Sanitary District	Linden Flood Pumping Station (East Kildonan) - Temporary Sewage Screen for 24" Pump	1952	M-174
Greater Winnipeg Sanitary District	Linden Flood Pumping Station (East Kildonan) - Temporary Sewage Screen for 30" Pump	1952	M-175
The Metropolitan Corporation of Greater Winnipeg Waterworks & Waste Disposal Division	Linden Outfall - Weir & Flap Gate	1965	S - 314
The City of Winnipeg, Works and Operations Division, North East District	Linden Avenue Outfall Concrete Removal and Rip-Rap	1993	NE - 1294
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Linden Flood Pump Station Flap Gate Installation Arrangement and Concrete Outlines	1993	LD-1296

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The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Linden, Newton, Mission and Armstrong Flood Control Upgrading Project - Armstrong Gate Chamber Sluice Gate & Flap Gate Installation, Arrangement & Concrete Outlines	1993	LD -1300, File #FP10409
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Linden, Newton, Mission and Armstrong Flood Control Upgrading Project - Miscellaneuos Metal Details	1993	LD - 1302, File #FP10411
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Linden Flood Station Automatic Level Control and Alarm System - Wiring Diagram and Panel Layout	1994	49-FS-Q-1
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Linden Flood Station Automatic Level Control and Alarm System - Wiring Diagram and Panel Layout		45-FS-Q-1
	MAGER		
Greater Winnipeg Dyking Board	Mager Drive Pumping Station	1951	1-SD-1 & 1-SD-2
Greater Winnipeg Dyking Board	Mager Drive & Hart Avenue Pumping Stations - Electrical Layout	1951	1-E-1, #FP10044
Greater Winnipeg Sanitary District	Mager Drive Pump Station to Dyke Board Station Flood Pumping Connection	1952	M-147
Greater Winnipeg Sanitary District	Mager Flood Pumping Station (St. Vital) - Temporary Sewage Screen for 30" Pump	1952	M-153
Greater Winnipeg Sanitary District	Mager Flood Pumping Station (St. Vital) - Temporary Sewage Screen for 20" Pump	1952	M-154
Templeton Engineering Company	Mager Drive Pumping Station - City of St. Vital Replacement of 60" dia. Outfall	1968	SV - 1 - 142
The Metropolitan Corporation of Greater Winnipeg Waterworks & Waste Disposal Division	Mager Pumping Station - Proposed Layout of Pump Room Alterations	1972	S - 367
The City of Winnipeg Sewage Disposal Department	Mager Pump Station Alterations - Pump Room, Motor Room and Sump	1973	768
The City of Winnipeg Sewage Disposal Department	Mager Pump Station Alterations - Valve Chamber Details	1973	769
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Major Drive Pumping Station Cross Sections	1974	M - 305A
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Major Drive Pumping Station Cross Sections	1974	M - 305B
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Major Drive Pumping Station Cross Sections	1974	M - 305C
Greater Winnipeg Sanitary District	Mager Drive Flood Station - Automatic Level Control Schematic Diagram	1984	51-FS-Q-1
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mager, Baltimore and La Verendrye Flood Pumping Stations / Mager Station Gate Installation Arrangement and Concrete Outlines	1988	LD - 897
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Mager Station Gate Installation Reinforcing Steel	1988	LD-898
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Mager, Baltimore & La Verendrye Flood Pumping Stations	1988	LD-902, #FP10366
Greater Winnipeg Sanitary District	Mager Flood Pumping Station (St. Vital) - Temporary Sewage Screen for 24" Pump		M-176
	MARION		
Greater Winnipeg Dyking Board	Marion St. Pumping Station Electrical Layout	1951	2-E-2
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Marion Street Pumping Station (Sheet 1 of 2)	1951	2-SD-5, File #SD10225
Greater Winnipeg Dyking Board	Marion Street Pumping Station (Sheet 1 of 2)	1951	2-SD-5-1
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Marion Street Pumping Station (Sheet 2 of 2)	1951	2-SD-5-2, File #FP10064
Greater Winnipeg Dyking Board	Marion Street Pumping Station (Sheet 2 of 2)	1951	2-SD-5-2, File #FP10065
Greater Winnipeg Sanitary District	Marion Flood Pumping Station (St. Boniface) - Temporary Sewage Screen for 2-30" Pumps	1952	M158, File #FP10285
Greater Winnipeg Sanitary District	Marion Flood Pumping Station (St. Boniface) - Temporary Sewage Screen for 24" Pumps	1952	M159, File #FP10335
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Marion St. Pumping Station - Detail of Proposed Steel Sluice Gate	1957	2-SD-5A
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Marion Flood Station Automatic Level Control Schematic Diagram and Alarm Panel Layout	1980	53-FS-Q-1
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Marion Sewage Lift and Flood Station Electrical Renovations	1990	53-FS-Q-2
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Marion Place & Norwood Bridge - 3 Dimensional Schematic Pumping Stations	1991	M-524A

Author	Title	Year	Drawing #
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Marion Street - Site Plan/Demolition Plan	1995	LD-1794
	MAYFAIR		
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Public Lane Stradbrook Ave. to Mayfair Ave. Junction Chamber Details-Main St. & Norwood Bridges Projects	1995	4110
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ 1600DIA. Outfall and Details - Main St. & Norwood Bridges Project	1995	4111
The City of Winnipeg Streets and Transportation Department Bridge Engineering Division	Mayfair Pumping Station, Pipe Systems, and Related Works/ Building Elevations and Sections - Main St. & Norwood Bridges Project	1995	4112
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Work/ Sections and Details - Main St. & Norwood Bridges Project	1995	4114
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Plan Above EL 220.975 - Plan Above EL 225.500 and Details-Main St. & Norwood Bridges Project	1995	4119
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Work/ Building Sections Sheet No. 1 - Main St. & Norwood Bridges Project	1995	4121
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Building Sections Sheet No. 2 - Main St. & Norwood Bridges Project	1995	4122
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Building Sections Sheet No. 3 - Main St. & Norwood Bridges Project	1995	4123
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Pump and Valve Room Floor Plans and Pipe Schedule-Main St. & Norwood Bridge Project	1995	4129
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Main Floor Plan & Details - Main St. & Norwood Bridges Project	1995	4130
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Sections Sheet No. 1 - Main St. & Norwood Bridges Project	1995	4131
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Sections Sheet No.2 - Main St., & Norwood Bridges Project	1995	4132
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Sections Sheet No.3 - Main St. & Norwood Bridges Project	1995	4133
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Mechanical Pump Room and Valve Room Floor Plans and Details - Main St & Norwood Bridges Project	1995	4134
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Work/ Mechanical Main Floor Plan Building Section and Legend - Main St. & Norwood Bridges Project	1995	4135
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Site Plan Limits of Work Storage and Site Office Areas-Main St.& Norwood Bridges Project	1997	4106
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Public Lane Stradbrook Ave. to Mayfair Ave. Underground Sysytem Works-Main St. & Norwood Bridges Project	1997	4107
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mayfair Pumping Station, Pipe Systems, and Related Works/ Mayfair Avenue Public Lane to Main - Main St. & Norwood Bridges Project	1997	4108
	METCALFE		
Greater Winnipeg Dyking Board	Metcalfe Place Pumping Station	1951	2-SD-4, File #FP10063
Greater Winnipeg Dyking Board	Metcalfe Place station	1951	DRG, No 2 -SD - 4, File #LD10216
Greater Winnipeg Dyking Board	Metcalfe & Baltimore Road Pumping Stations - Electrical Layout	1951	5-E-5
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Metcalfe Flood Station Automatic Level Control Schematic Diagram & Alarm Panel Layout	1980	55-FS-Q-1
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Metcalfe Secondary Sewer Relocation	1985	1163, File #SS10166
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Metcalfe Secondary Sewer Relocation - Detail "A" to "D", Building Detail	1986	1164

Author	Title	Year	Drawing #
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Metcalfe Secondary Sewer - Detail "E", Building Detail	1986	1165
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Metcalfe Gate Chamber - Site Plan (1 of 4)	2003	LD-2900
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Metcalfe Gate Chamber - Plan and Profile (2 of 4)	2003	LD-2901
	MISSION		
Greater Winnipeg Dyking Board	Mission St. - Pumping Station Sheet 1 of 2	1951	2-SD-6-1, File #FP10393
Greater Winnipeg Dyking Board	Mission St. - Pumping Station Sheet 2 of 2	1951	2-SD-6-2, File #FP10068
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mission Flood Station Automatic Level Control and Alarm System-Wiring Diagram and Panel Layout	1990	57-FS-Q-1
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mission, Linden, Newton and ArmstrongFlood Control Upgrading Project - Mission Flood Pump Station Flap Gate Installation Arrangement and Concrete Outlines	1993	LD - 1293, File #FP10402
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Dept.	Mission, Linden, Newton and Armstrong Flood Control Upgrading Project - Mission Flood Pump Station Flap Gate Removal	1995	LD - 1295, File #FP10404
	MUNROE		
Greater Winnipeg Dyking Board	Munroe Avenue Pumping Station	1951	3-SD-1-1, File #FP10071
Greater Winnipeg Dyking Board	Munroe Avenue Pumping Station	1951	3-SD-1-2, File #FP10072
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Munroe Gate Chamber Flap Gate Installation	1965	527
	Munroe Flood Pumping Station	1980	1017, File #GC10040
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Munroe Outfall Repairs, Site Plan, Profile and Details Sheet 13 of 14	1987	LD-857 D4-988
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Munroe Ave. Comm. & Pumping Station - Existing Details		152
Greater Winnipeg Sanitary District	Munroe Avenue Pumping Station - Superstructure		353
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Munroe - Polson River Crossing (Alterations to Munroe Ave. Pumping Station & Prop. Siphon Inlet Chamber)		506
	NEWTON		
Greater Winnipeg Dyking Board	Newton & Robert Ave. Pumping Stations - Electrical Layout	1951	5-E-6, File #FP10056
Greater Winnipeg Dyking Board	Newton Avenue Pumping Station	1951	4-SD-2-1 & 4-SD 2-2
Greater Winnipeg Sanitary District	Newton Flood Pumping Station - Temp. Sewage Screen for 24" Pump	1952	M-176, File #FP10348
Greater Winnipeg Sanitary District	Newton Flood Pumping Station - Temp. Sewage Screen for 30" Pump	1952	M-177, File #FP10349
City of Winnipeg Works & Operations Division-Waterworks Waste & Disposal Department	Newton Flood Station Automatic Level Control & Alarm System Wiring Diagram and Panel Layout	1983	61-FS-Q-1
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Newton Flood Station Automatic Level Control & Alarm System Wiring Diagram and Panel Layout	1985	61-FS-Q-1, File #FP10130
The City of Winnipeg, Works and Operations Division	Newton Ave. River Outfall Forcemain Crossing and Detail Sheet	1988	LD - 958, File #ID10310
The City of Winnipeg, Works and Operations Division	Newton Avenue River Outfall - Reconstruction - Plan and Profile	1988	LD - 956, File #OH10049
The City of Winnipeg, Works and Operations Division	Newton Avenue River Outfall - Reconstruction - Plan, Section and Details	1988	LD - 957, File #OH10050
The City of Winnipeg, Works and Operations Division	Newton, Linden, Mission and Armstrong Flood Control Upgrading Project - Newton Flood pump Station - Flap Gate Installation Arrangement - Concrete Outlines	1993	LD - 1298, File #FP10407
	POLSON		
Greater Winnipeg Dyking Board	Polson Avenue Flood Pumping Station	1951	5-SD-4-1, File #SP10551
City of Winnipeg, Waterworks, Waste and Disposal Department	Polson Flood Pumping Station	1951	5-SD-4-2, File #SP10552
City of Winnipeg, Waterworks, Waste and Disposal Department	Polson Comminutor Station - Site Plan, Profile, & Miscellaneous Details	1964	513
City of Winnipeg, Waterworks, Waste and Disposal Department	Polson Comminutor Station - Ventilation Details	1964	514
City of Winnipeg, Waterworks, Waste and Disposal Department	Polson Comminutor Station Construction Details	1964	511
City of Winnipeg, Waterworks, Waste and Disposal Department	Polson Comminutor Station Reinforcing Steel Details	1964	512

Author	Title	Year	Drawing #
City of Winnipeg Works & Operations Division-Waterworks Waste & Disposal Department	Polson Flood Station Automatic Level Control and Alarm System-Wiring Diagram and Panel Layout	1989	68-FS-Q-1
The City of Winnipeg, Works and Operations Division, Operations Department - District 3	Polson Avenue Outfall - Site Plan and Proposed Outfall Reconstruction	1990	1338, File #OJ10011
The City of Winnipeg, Works and Operations Division, Operations Department - District 3	Polson Avenue Outfall - Site Plan and Proposed Outfall Reconstruction	1990	3S-2402
City of Winnipeg, Waterworks, Waste and Disposal Department	Polson Flood Pumping Station - Flap Gate Installation	1992	LD-2643, File #FP10040
City of Winnipeg, Waterworks, Waste and Disposal Department	Polson Flood Pumping Station - Pumping Station Access Hatch	1992	LD-2644, File #FP10041
City of Winnipeg, Waterworks, Waste and Disposal Department	Polson Flood Pumping Station - Concrete Slab Repair Sheet 1 of 1	2003	LD-2960
Greater Winnipeg Dyking Board	Polson & Boyle Pumping Stations Electrical Layout		5-E-4
Greater Winnipeg Dyking Board	Polson & Boyle Pumping Stations Electrical Layout		5-E-4
	RAVELSTON		
City of Transcona	Ravelston - Pumphouse Plans and Details	1966	LD-1831
City of Transcona	Ravelston - Pumphouse Plans and Details	1966	LD-1832
City of Transcona	Ravelston - Pumphouse Electrical Layout	1966	LD-1835
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Ravelston - Transcona Deep Storage Facility Enlargement of Stormwater Retention Basin -Site Plan	1976	LD-1836
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Ravelston - Transcona Deep Storage Facility- Supply of Pump No. 3	1976	LD-1837
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Ravelston - Transcona Deep Storage Facility - Installation of Pump No. 3 Mech & Structural Details	1976	LD-1839
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Ravelston - Transcona Deep Storage Facility - Installation of Pump No. 3 - Pumping Station Electrical	1978	LD-1840
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Ravelston - Enlargement of Stormwater Retention Basin Sections and Details	1978	LD-1841
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Ravelston - Transcona Deep Storage Facility - Installation of Pump No. 3 Manhole Detail - Electrical	1978	LD-1842
City of Winnipeg, Works and Operations Department, Waterworks Waste and Disposal Department	Transcona Deep Storage Installation of Pump no.3 Manhole Detail Electrical As Built (Ravelston Lift Station)	1985	71-FS-Q-1
	ROLAND		
City of Winnipeg Engineering Department	Roland Street at Red River - Replacing Outfall Sewer	1958	SC14979, FILE#10016
City of Winnipeg Engineering Department	Roland Street Flood Pumping Station Floor Plan and Details - Reinforcing Steel (1)	1961	R 228
City of Winnipeg Engineering Department	Roland Street Flood Pumping Station Floor Plan and Details	1961	R 229 - F
City of Winnipeg Engineering Department	Roland Street Flood Pumping Station Substructure Sectional Elevations	1961	R 229 - H
City of Winnipeg Engineering Department	Roland Street Flood Pumping Station Floor Plan & Details	1962	R-229M
City of Winnipeg Engineering Department	Roland Street Flood Pumping Station Substructure Sectional Elevations - Reinforcing Steel (3)	1962	R 229 - O
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Pumping Station to Gate Chamber - Connecting piping and Details	1985	LD-778
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Roland Flood Station-Electrical and Control	1997	97-FS-Q-1
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Roland Street Flood Pumping Station Gate Relocation - Site Plan and Demolition Drawing	1999	LD - 1768
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Roland Street Flood Pumping Station Gate Relocation - Plan And Details	1999	LD - 1769
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Roland Flood Pumping Station Gate Relocation - Reinforcing Details	1999	LD - 2066
The City of Winnipeg, Water and Waste Department	Roland Flood Pumping Station - Miscellanenous Metal Details	1999	LD - 2067
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station Substructure Sections - Reinforcing Steel		R-229?
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station Pump Layout Details		R-229-A
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station Outfall & Site Plan		R-229-B

Author	Title	Year	Drawing #
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station - Superstructure (Plans and Elevations)		R-229-C
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station - Superstructure (Wall Sections and Details)		R-229-D
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station - Superstructure (Transformer Room - Special Steel Door Details)		R-229-E
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station - Floor Plan and Details		R-229-F
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station - Substructure Sections		R-229-G
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station - Substructure Sectional Elevations		R-229-H
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station - Miscellaneous Details (2)		R-229-K
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Roland Street Flood Pumping Station - Electrical		R-229-L
	SELKIRK		
Greater Winnipeg Dyking Board	Selkirk - Pumping Station	1951	5-SD-1-1
Greater Winnipeg Dyking Board	Selkirk - Pumping Station	1951	5-SD-1-2
Greater Winnipeg Sanitary District	Selkirk Comminutor Station - Proposed Plot Plan	1954	275
Greater Winnipeg Sanitary District	Selkirk Ave. Comminutor Station - Floor Plans & Comm. Basin Details	1954	276
Greater Winnipeg Sanitary District	Selkirk Ave. Comminutor Station - Sections thru Channels of Flow & Superstructure Details	1954	277
Greater Winnipeg Sanitary District	Selkirk Ave. Comminutor Station - Comminutor Outlet Cover	1954	278
Greater Winnipeg Sanitary District	Selkirk Ave. Comminutor Station - Reinforced Concrete Details of Floor Slabs	1954	281
Greater Winnipeg Sanitary District	Selkirk Ave. Comminutor Station - Reinforced Concrete Details, Vertical Sections	1954	282
The City of Winnipeg, Works and Operations Division - Operations Dept. - Northwest District	Selkirk Ave. & Syndicate St. - 1992 Outfall Reconstruction - Sections and Details	1993	4280
The City of Winnipeg, Works and Operations Division - Operations Dept. - Northwest District	Selkirk Ave. & Syndicate St. - 1993 Outfall Reconstruction - Sections and Details	1993	4281
City of Winnipeg, Waterworks, Waste and Disposal Department	Selkirk Ave. Outfall - Site Plan and Outfall Reconstruction	1993	#0010053, PD #92-16
The City of Winnipeg, Works and Operations Division, Waterworks, Waste and Disposal Department	Selkirk Ave. Outfall - Site Plan and Outfall Reconstruction	1993	LD - 1258
The City of Winnipeg Water and Waste Department	Selkirk Flood Pumping Station Flapgate Relocation	2001	LD-2412
The City of Winnipeg Water and Waste Department	Selkirk Flood Pumping Station-Flapgate Relocation-Plan and Miscellaneous Details	2001	LD-2413
The City of Winnipeg Water and Waste Department	Selkirk Flood Pumping Station Reinforcing Details	2001	LD-2414
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Selkirk Ave. & Syndicate St. - 1992 Outfall Reconstruction - Section and Details		LD-1260
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Selkirk Ave. & Syndicate St. - 1992 Outfall Reconstruction		LD-1261
	ST. JOHNS		
Greater Winnipeg Dyking Board	St. John's Ave.& Syndicate St. - Pumping Stations Electrical Layout	1951	5-E-2
Greater Winnipeg Dyking Board	St. Johns Ave. Pumping Station	1951	5-SD-6-1
Greater Winnipeg Dyking Board	St. Johns Ave. Pumping Station	1951	5-SD-6-2, #SP10557
City of Winnipeg, Waterworks, Waste and Disposal Department	St. Johns Comminutor Station Site Plan & Miscellaneous Details	1965	526
City of Winnipeg, Waterworks, Waste and Disposal Department	St. Johns Comminutor Station Construction Details	1967	524
City of Winnipeg, Waterworks, Waste and Disposal Department	St. Johns Comminutor Station Reinforcement Details	1967	525
City of Winnipeg, Waterworks, Waste and Disposal Department	St Johns Park - Sta 35+25 to Outfall at Sta 35+79	1980	LD-451, File #LD10859
City of Winnipeg, Waterworks, Waste and Disposal Department	St Johns Park - Gate Chamber	1980	LD-455, File #GC10059
City of Winnipeg, Waterworks, Waste and Disposal Department	St Johns Park - Gate Chamber Details	1980	LD-456, File #GC10060

Author	Title	Year	Drawing #
The City of Winnipeg, Works and Operations Division, Water and Waste Department	St. Johns Ave. - 1995 Outfall Construction and Related Works - Site Plan	1997	LD - 1636
The City of Winnipeg, Works and Operations Division, Water and Waste Department	St. Johns Ave. - 1996 Outfall Construction and Related Works - Details	1997	LD - 1637
	SYNDICATE		
Greater Winnipeg Dyking Board	St. John's Ave.& Syndicate St. - Pumping Stations Electrical Layout	1951	5-E-2
Greater Winnipeg Dyking Board	Syndicate Street Pumping Station	1951	5-SD-5
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Syndicate Flood Pump Station-Automatic Level Control Diagram & Alarm Panel Layout	1987	85-FS-Q-1
Greater Winnipeg Dyking Board	Syndicate Street Pumping Station (Gate Modifications)	1990	5-SD-5C
The City of Winnipeg, Works and Operations Division - Operations Department - Northwest District	Selkirk Avenue Outfall - Site Plan and Outfall Reconstruction (Sheet 1 of 4)	1992	4278
The City of Winnipeg, Works and Operations Division - Operations Department - Northwest District	Syndicate Street Outfall / Site Plan and Proposed Outfall Reconstruction (Sheet 2 of 4)	1992	4279
The City of Winnipeg, Works and Operations Division - Operations Department - Northwest District	Syndicate St. and Selkirk Ave 1992 Outfall Reconstruction - Sections and Details (Sheet 3 of 4)	1992	4280
The City of Winnipeg, Works and Operations Division - Operations Department - Northwest District	Syndicate St. and Selkirk Ave 1992 Outfall Reconstruction - Sections and Details (Sheet 4 of 4)	1992	4281
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Syndicate & Boyle Combined Sewer District Integration / Syndicate Street Pumping Station - Site Plan, Grading and Outfall Details (Sheet 12 of 20)	1997	4208
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Syndicate & Boyle Sewer District Integration/ Miscellaneous Details - Standard Pipe Details and Large Diameter Connection Details	1997	4209, File #MS12889
The City of Winnipeg, Works and Operations Division, Water and Waste Department	Syndicate & Boyle Combined Sewer District Integration/ Miscellaneous Details - Interconection Piping Details and Miscellaneous Connection Details	1997	4210, File #MS12888
City of Winnipeg, Works and Operations Department, Waste and Disposal Division	Syndicate Street Outfall - Site Plan and Proposed Outfall Reconstruction		LD-1259
Greater Winnipeg Sanitary District	Syndicate Street Trunk Sewer - The New Dam & Outlet		M108
Greater Winnipeg Sanitary District	Syndicate Flood Pumping Station - Temporary Sewage Screen for 20" Pump		M167
Greater Winnipeg Sanitary District	Syndicate Flood Pumping Station - Temporary Sewage Screen for 14" Pump		M168
Greater Winnipeg Sanitary District	Syndicate & Boyle St. Trunk Sewer - Flood Gates & Weirs		M72
Greater Winnipeg Sanitary District	Syndicate Street & Boyle St. Trunk Sewer - Flood Gates & Weirs		M72
City of Winnipeg - Water & Waste Department	Outfall & Pump Station Upgrades (Map)		

APPENDIX B

DETAILED FLOOD PUMPING STATION REPORTS

(The Appendix is Contained in a Separate Volume)

APPENDIX C

PUMP SHAFT VIBRATION (INTERIM) REPORT

(This Appendix is Contained in a Separate Volume)

APPENDIX D

THERMAL SCANNING (INTERIM) REPORT

(This Appendix is Contained in a Separate Volume)

APPENDIX E

ULTRASONIC TEST DATA
STATION AND DISCHARGE PIPING WALL THICKNESS
FOR DUMOULIN, JESSIE, LINDEN AND NEWTON FPS

CANADIAN STRUCTURAL INSPECTION SERVICES LTD.
BOX 6 601 BOWMAN 36C-4 WPG. MAN. R2K 1P7
TEL. (204) 663-7775
FAX (204) 663-9464

January 31, 2005

Report 1 and Final
4867

ULTRASONIC WALL THICKNESS DETERMINATIONS ON 4 PUMPING STATIONS – FLOOD DISCHARGE AND SUCTION PIPES

Client:

KGS Group
3rd Floor - 865 Waverley Street
Winnipeg, Manitoba
R3T 5P4

Attention: Mr. Hugh Williams

We performed the above inspection and report as follows:

INSPECTION DATES: January 14, 27 and 28, 2005

Technicians: C. Winzinowich S. Quinsey

Equipment: Krautkramer Branson DM-2 Wall Thickness Gage
5.0 MHz Probe
DA303 2MHz Probe
Step Calibration Block
Couplant

SCOPE: Our scope as we understand was to obtain wall thickness determinations of the following areas at Linden, Newton, Dumoulin and Jesse Pump Stations:

- Discharge pipes just before it enters concrete wall.
- Casing on pump – 4 locations near bottom of casing.
- Suction pipe near concrete floor.

COMMENTS:

Wall thickness reading were taken and recorded on the attached sketches. Numbers indicated are in decimals of an inch or thousandths of an inch.

Thickness readings obtained varied on each pump at each station. The discharge pipes going into the concrete wall appear to be steel in material and readings are in the 0.100" to 0.400" range. The pump casings and pipe extending out of the concrete floor appears to be a cast in material on all 4 pump stations with exception of Jesse on pump #105. The pipe extending out of the ground at #105 appears to be steel, as reflected in attached readings. The overall thickness of the cast was quite thick averaging around 1.000".

Please find attached sketches of Ultrasonic Testing readings of the 4 pump stations.

Sincerely,

CANADIAN STRUCTURAL INSPECTION SERVICES LTD.

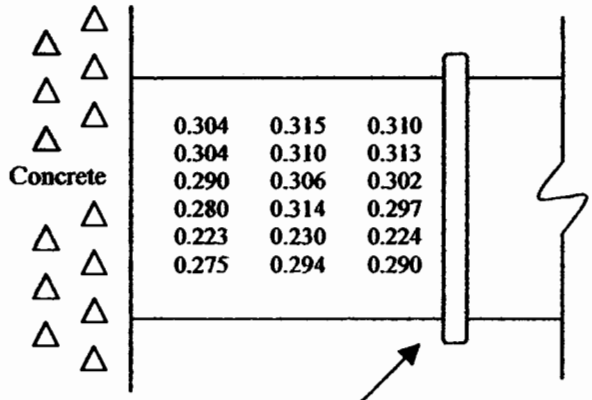
C. Thompson, C.E.T.

CRT/adr

Attach:

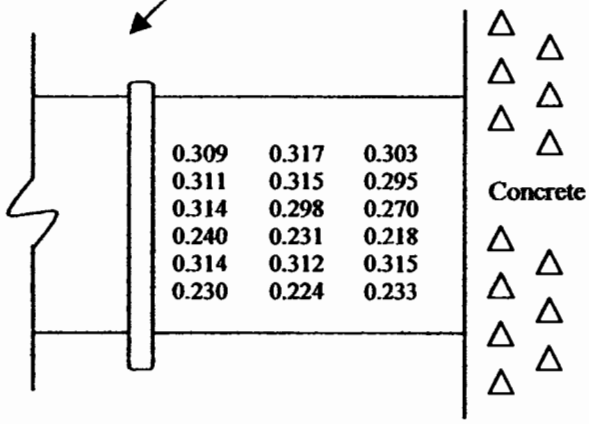
Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 14, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Linden #46	Pipe Diameter: 24"	
Description: NDT-U.T. Wall thickness Determinations Flood Pump Discharge Pipes		

* Readings listed below in thousandths of an inch or decimal inches

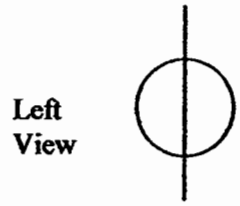


LEFT

victaulic ring



RIGHT



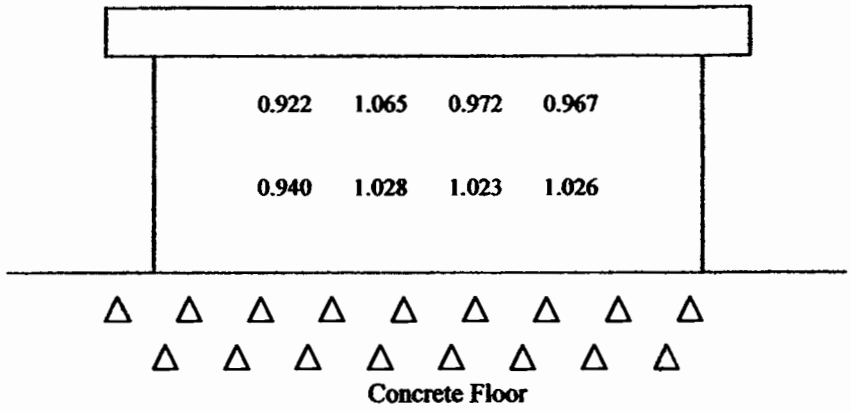
(facing pipe from pump side)

Notes: - Majority of readings taken on visible old markings from previous inspection in 2001.

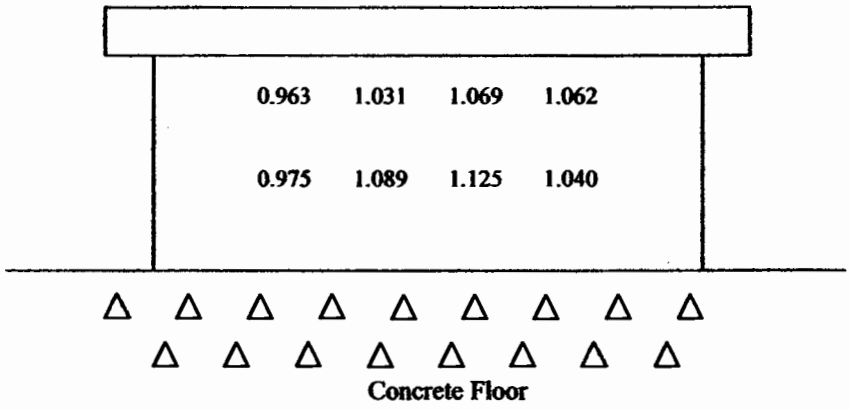
- Some pitting corrosion observed - ⅛" deep

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 27, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Linden #46	Pipe Diameter:	
Description: NDT U.T. Wall Thickness Determinations on Flood Pump Discharge Pipes Before Pump		

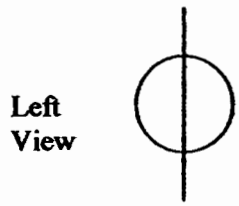
* Readings listed below in thousandths of an inch or decimal inches



LEFT



RIGHT



(looking down from top of pipe flange)

Notes: Pump Casing Readings: (Larger Diameter to Smaller Diameter on Casing)

Location #1 – 1.200"

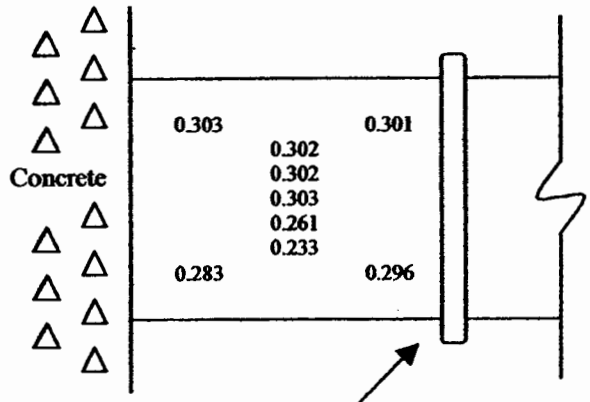
Location #2 – 1.007"

Location #3 – 1.039"

Location #4 – 0.746"

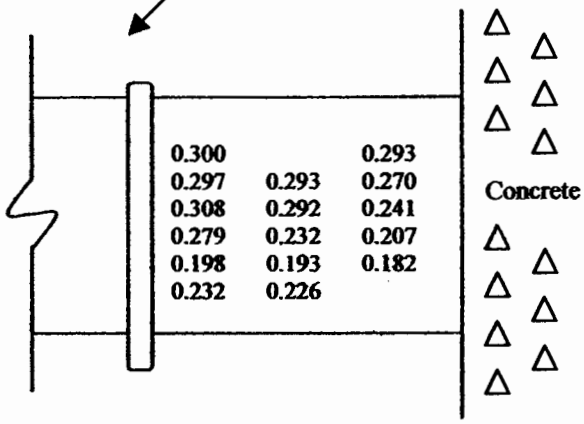
Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 14, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Linden #47	Pipe Diameter: 24"	
Description: NDT-U.T. Wall thickness Determinations Flood Pump Discharge Pipes		

* Readings listed below in thousandths of an inch or decimal inches

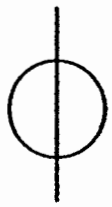


LEFT

victaulic ring



RIGHT



Left View — Right View

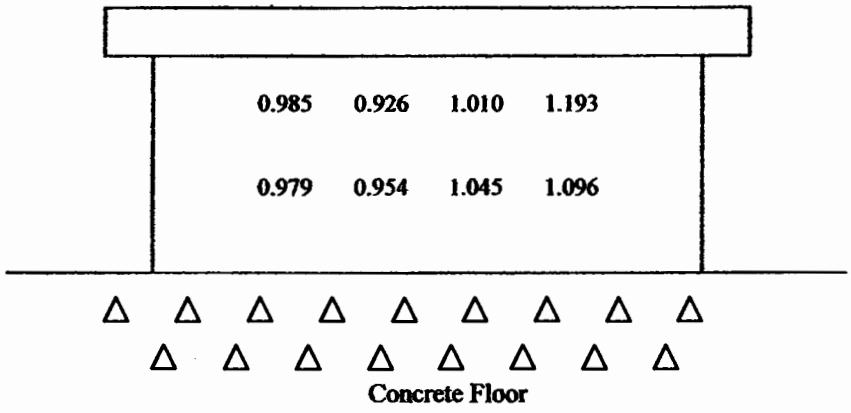
(facing pipe from pump side)

Notes: - Some minor surface pitting observed.

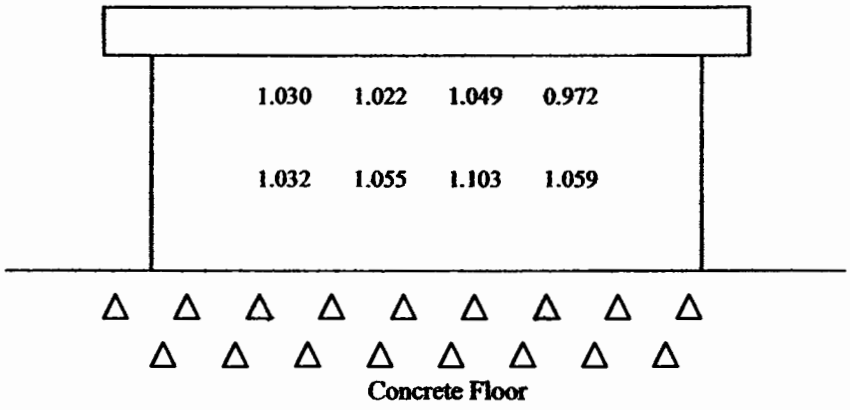
- Some external rust flaking on bottom of pipe.

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 14, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Linden #47	Pipe Diameter:	
Description: NDT U.T. Wall Thickness Determinations on Flood Pump Discharge Pipes Before Pump		

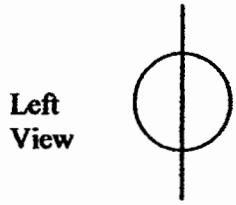
* Readings listed below in thousandths of an inch or decimal inches



LEFT



RIGHT



(looking down from top of pipe flange)

Notes: Pump Casing Readings: (Larger Diameter to Smaller Diameter on Casing)

Location #1 – 1.148"

Location #2 – 0.980"

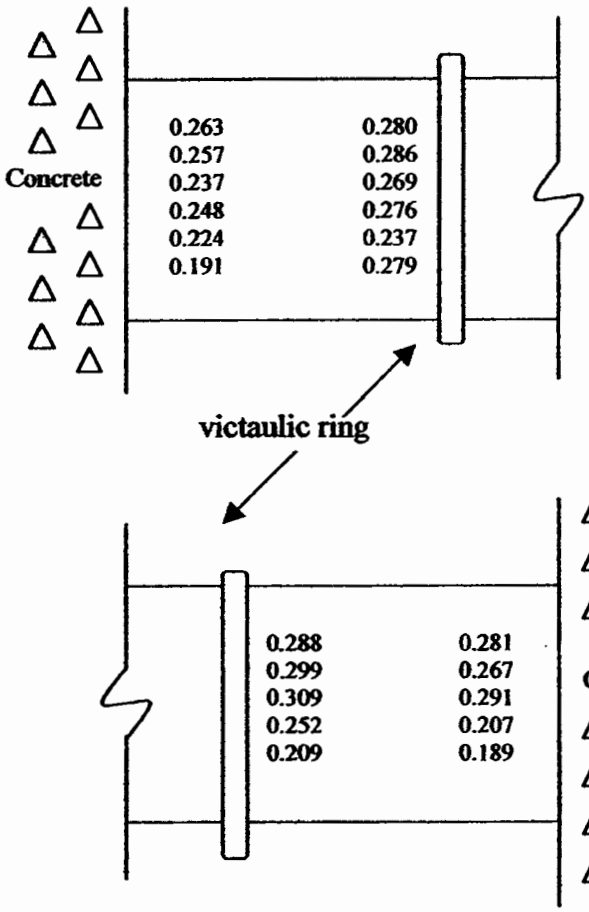
Location #3 – 0.957"

Location #4 – 1.077"

- Some heavy surface pitting on pipe – approximately ⅛" deep

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 14, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Newton #50	Pipe Diameter: 24"	
Description: NDT-U.T. Wall thickness Determinations Flood Pump Discharge Pipes		

* Readings listed below in thousandths of an inch or decimal inches



LEFT

RIGHT



Left View **Right View**

(facing pipe from pump side)

Notes: _____

_____

_____

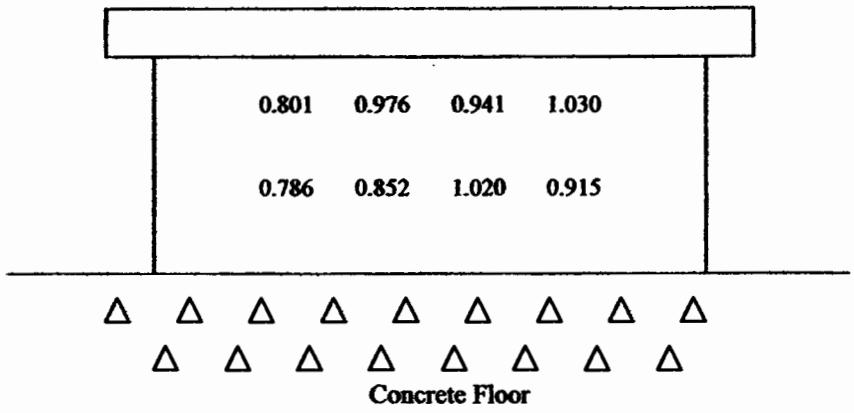
_____

_____

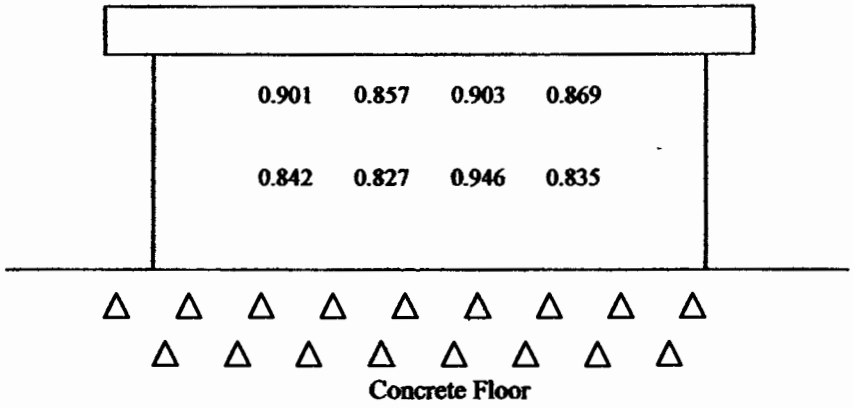
_____

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 27, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Newton #50	Pipe Diameter:	
Description: NDT U.T. Wall Thickness Determinations on Flood Pump Discharge Pipes Before Pump		

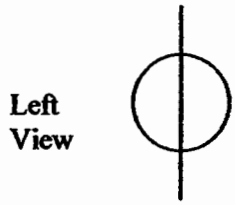
* Readings listed below in thousandths of an inch or decimal inches



LEFT



RIGHT



(looking down from top of pipe flange)

Notes: Pump Casing Readings: (Larger Diameter to Smaller Diameter on Casing)

Location #1 – 1.035"

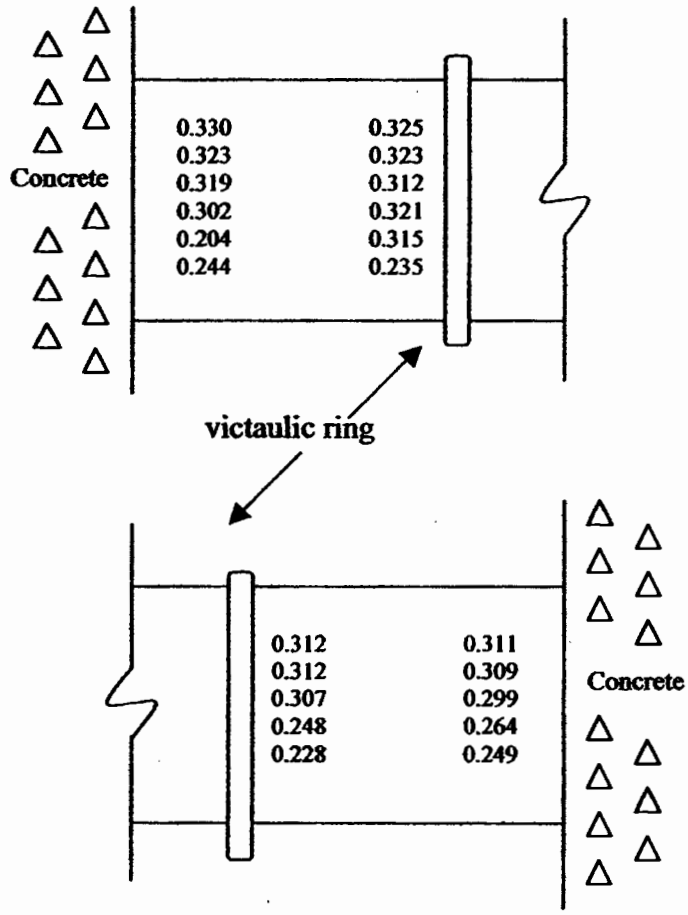
Location #2 – 1.165"

Location #3 – 1.037"

Location #4 – 1.831"

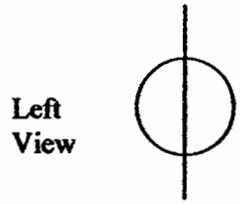
Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 14, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Newton #52	Pipe Diameter: 24"	
Description: NDT-U.T. Wall thickness Determinations Flood Pump Discharge Pipes		

* Readings listed below in thousandths of an inch or decimal inches



LEFT

RIGHT

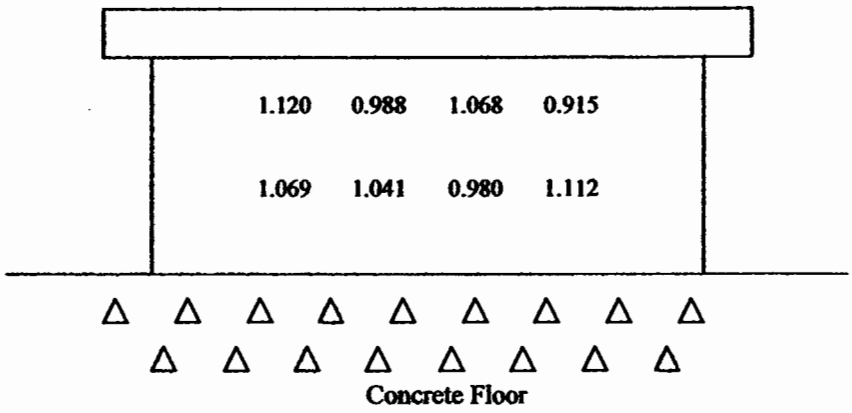


(facing pipe from pump side)

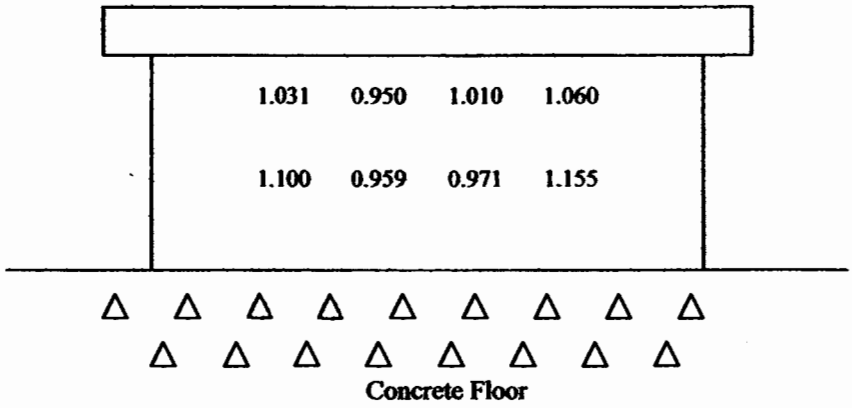
Notes: _____

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 27, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Newton #52	Pipe Diameter:	
Description: NDT U.T. Wall Thickness Determinations on Flood Pump Discharge Pipes Before Pump		

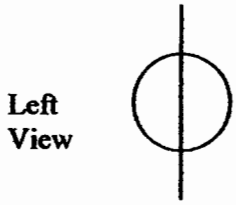
* Readings listed below in thousandths of an inch or decimal inches



LEFT



RIGHT



(looking down from top of pipe flange)

Notes: Pump Casing Readings: (Larger Diameter to Smaller Diameter on Casing)

Location #1 – 0.984"

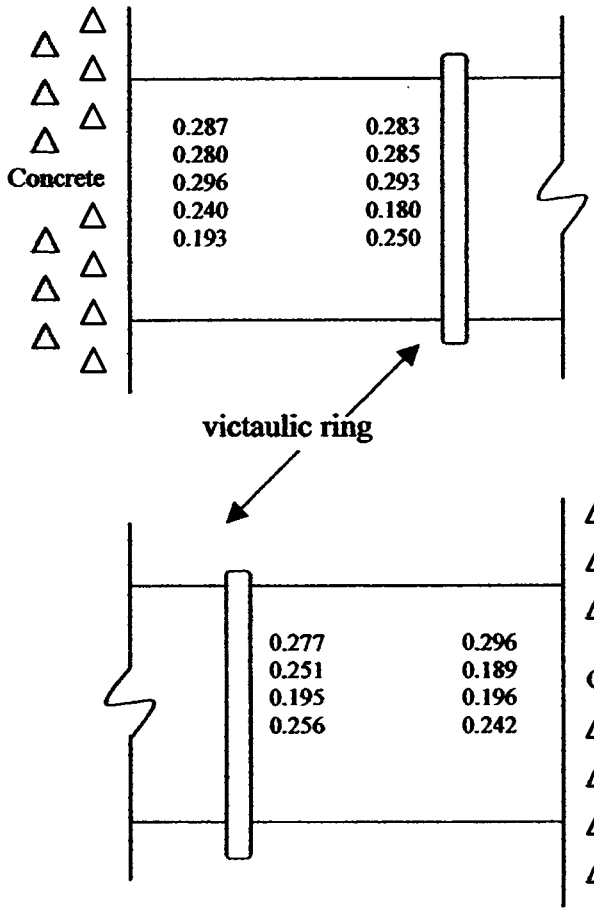
Location #2 – 0.960"

Location #3 – 0.865"

Location #4 – 0.984"

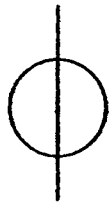
Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 28, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Dumoulin #36	Pipe Diameter: 20"	
Description: NDT-U.T. Wall Thickness Determinations Flood Pump Discharge Pipes		

* Readings listed below in thousandths of an inch or decimal inches



LEFT

RIGHT



Left View

Right View

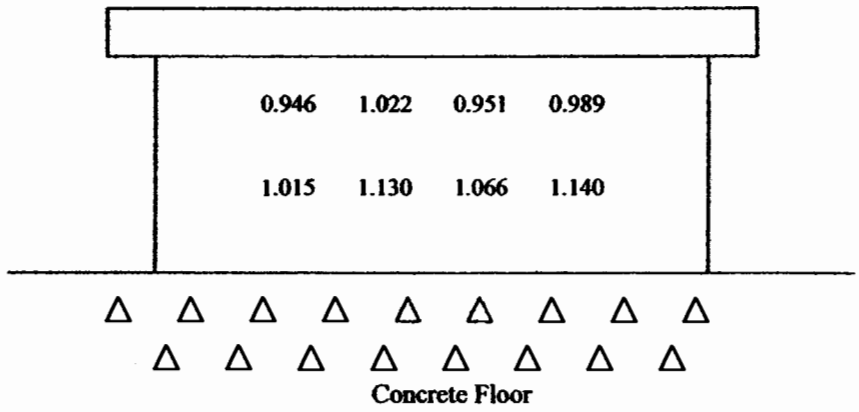
(facing pipe from pump side)

Notes: - Majority of readings taken on visible old markings from previous inspection in 2001.

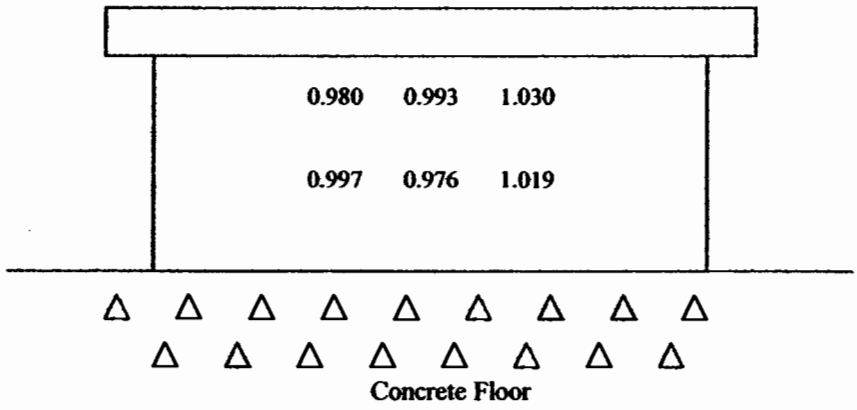
- Several areas of external pitting corrosion on lower section of pipe.

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 28, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Dumoulin #36	Pipe Diameter:	
Description: NDT U.T. Wall Thickness Determinations on Flood Pump Discharge Pipes Before Pump		

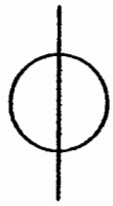
* Readings listed below in thousandths of an inch or decimal inches



LEFT



RIGHT



(looking down from top of pipe flange)

Notes: Pump Casing Readings: (Larger Diameter to Smaller Diameter on Casing)

Location #1 – 1.280"

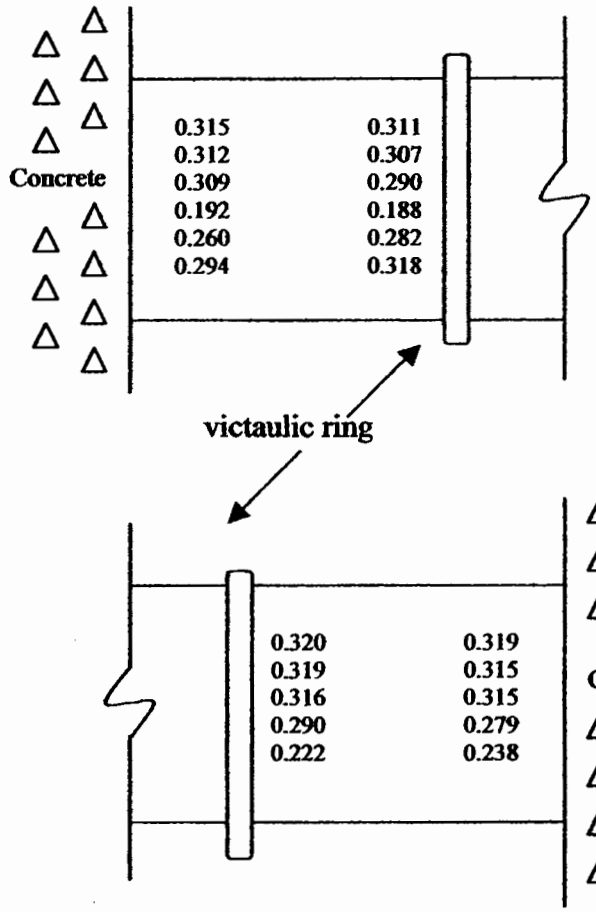
Location #2 – 1.224"

Location #3 – 0.991"

Location #4 – 0.755"

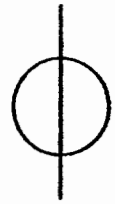
Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 28, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Dumoulin #38	Pipe Diameter: 30"	
Description: NDT-U.T. Wall thickness Determinations Flood Pump Discharge Pipes		

* Readings listed below in thousandths of an inch or decimal inches



LEFT

RIGHT



Left View

Right View

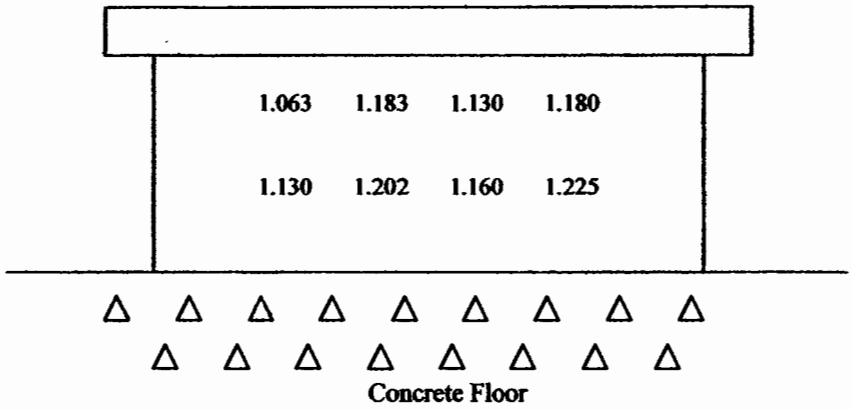
(facing pipe from pump side)

Notes: - Several areas of external pitting corrosion on the outside of pipe

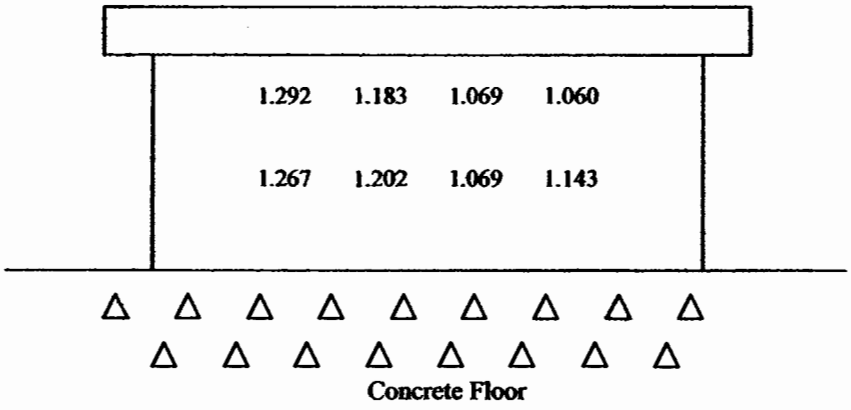
- Majority of readings taken on visible old markings from previous inspection in 2001

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 28, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Dumoulin #38	Pipe Diameter:	
Description: NDT U.T. Wall Thickness Determinations on Flood Pump Discharge Pipes Before Pump		

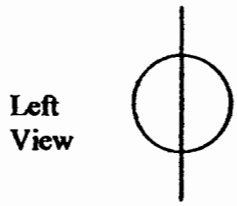
* Readings listed below in thousandths of an inch or decimal inches



LEFT



RIGHT



(looking down from top of pipe flange)

Notes: Pump Casing Readings: (Larger Diameter to Smaller Diameter on Casing)

Location #1 – 1.220"

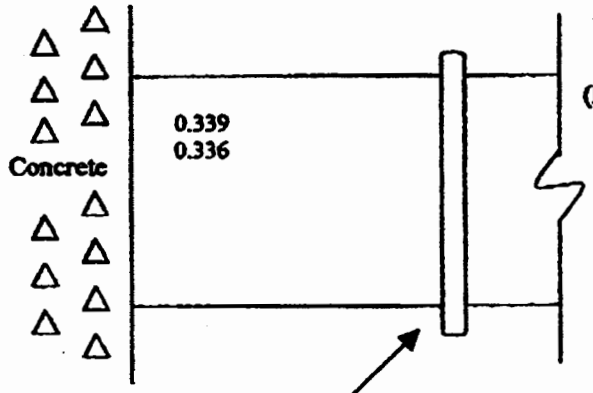
Location #2 – 1.150"

Location #3 – 1.075"

Location #4 – 1.117"

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 27, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Jesse #105	Pipe Diameter: 24"	
Description: NDT-U.T. Wall thickness Determinations Flood Pump Discharge Pipes		

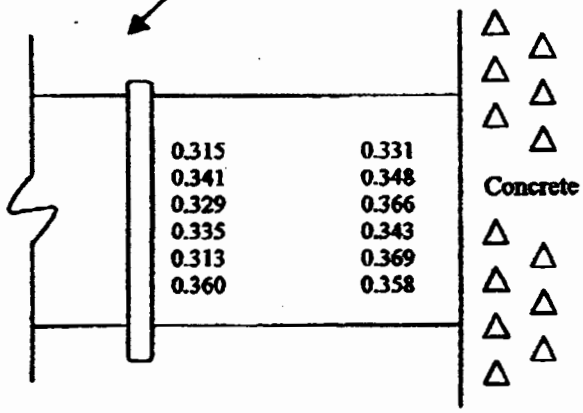
* Readings listed below in thousandths of an inch or decimal inches



(Left side inaccessible, flanges by concrete and vent in way)

LEFT

victaulic ring



RIGHT



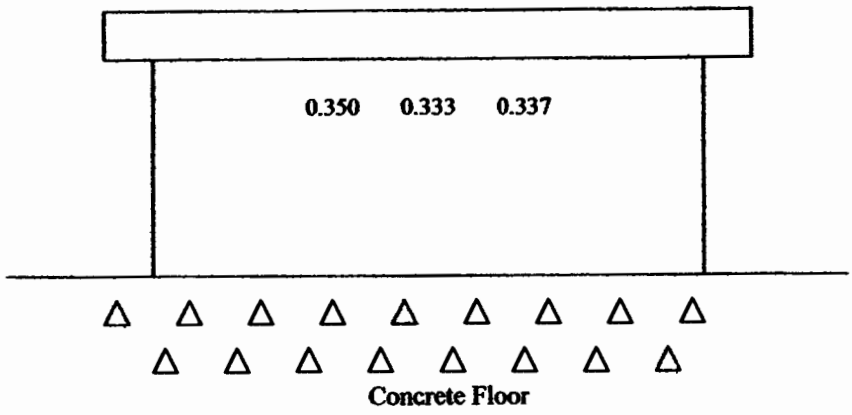
Left View — Right View

(facing pipe from pump side)

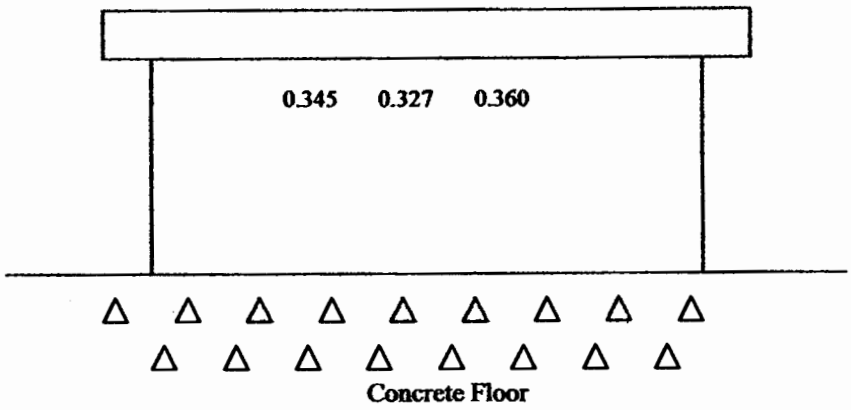
Notes: _____

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 27, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Jesse #105	Pipe Diameter:	
Description: NDT U.T. Wall Thickness Determinations on Flood Pump Discharge Pipes Before Pump		

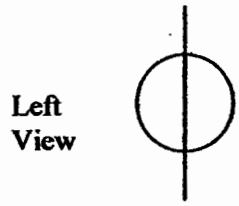
* Readings listed below in thousandths of an inch or decimal inches



LEFT



RIGHT



(looking down from top of pipe flange)

Notes: Pump Casing Readings: (Larger Diameter to Smaller Diameter on Casing)

Location #1 – 1.003"

Location #2 – 1.124"

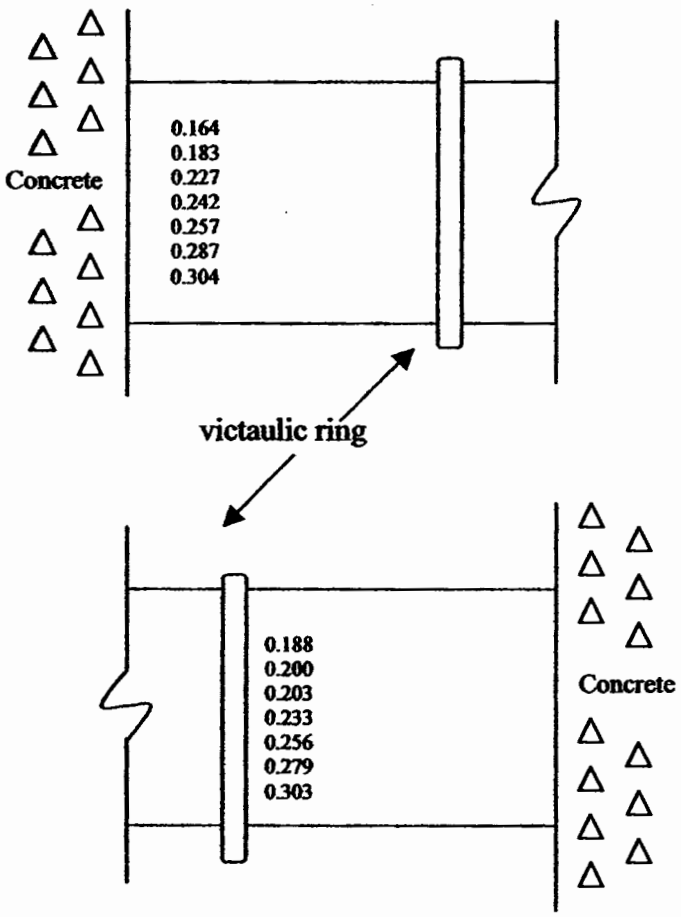
Location #3 – 1.285"

Location #4 – 1.202"

- Newer style of pump in comparison to other pumps. 3" of pipe extending out of floor, only able to take 1 reading per location.

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 27, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Jesse #106	Pipe Diameter: 30"	
Description: NDT-U.T. Wall thickness Determinations Flood Pump Discharge Pipes		

* Readings listed below in thousandths of an inch or decimal inches



LEFT

RIGHT

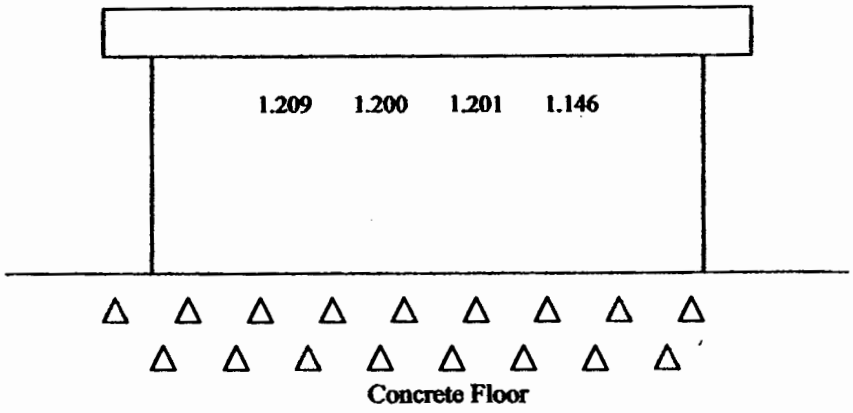
Left View — Right View

(facing pipe from pump side)

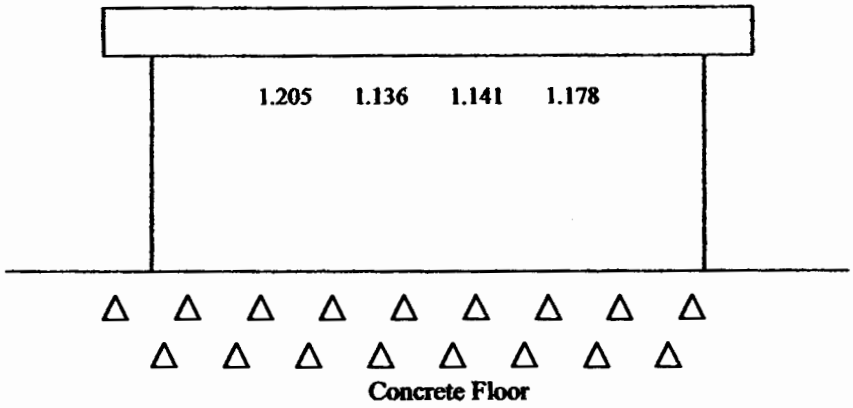
Notes: _____

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 27, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Jesse #106	Pipe Diameter:	
Description: NDT U.T. Wall Thickness Determinations on Flood Pump Discharge Pipes Before Pump		

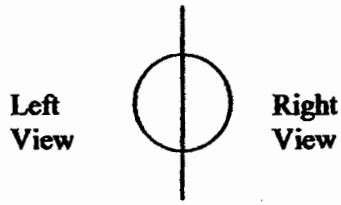
* Readings listed below in thousandths of an inch or decimal inches



LEFT



RIGHT



(looking down from top of pipe flange)

Notes: Pump Casing Readings: (Larger Diameter to Smaller Diameter on Casing)

Location #1 – 0.844"

Location #2 – 0.879"

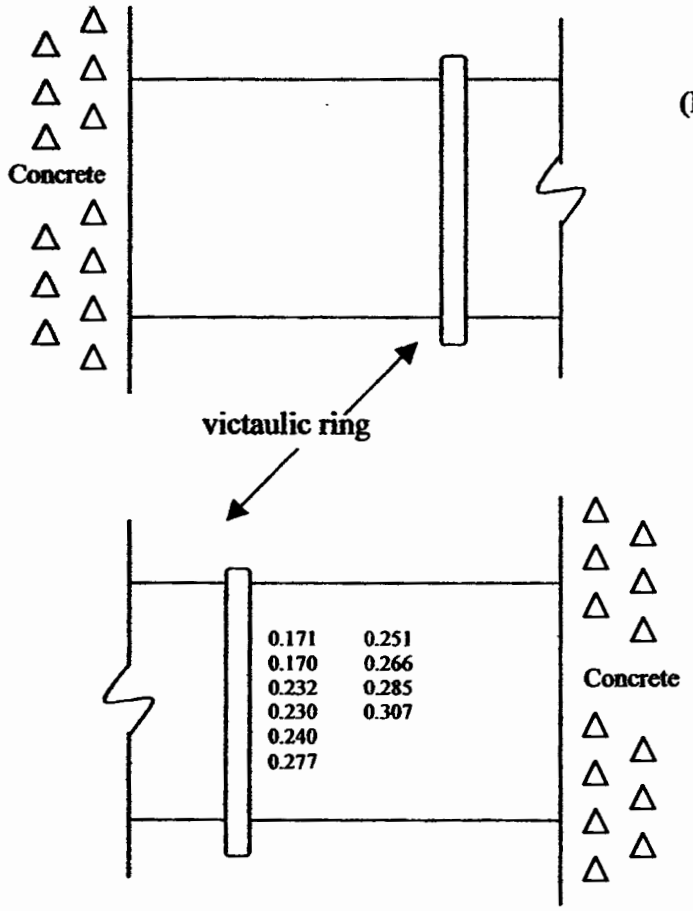
Location #3 – 0.783"

Location #4 – 1.065"

- 3" of pipe extending out from floor – only 1 reading taken at each location.

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 27, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Jesse #107	Pipe Diameter: 30"	
Description: NDT-U.T. Wall thickness Determinations Flood Pump Discharge Pipes		

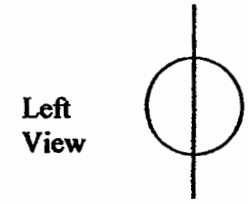
* Readings listed below in thousandths of an inch or decimal inches



(Left side inaccessible concrete column beside pipe)

LEFT

RIGHT

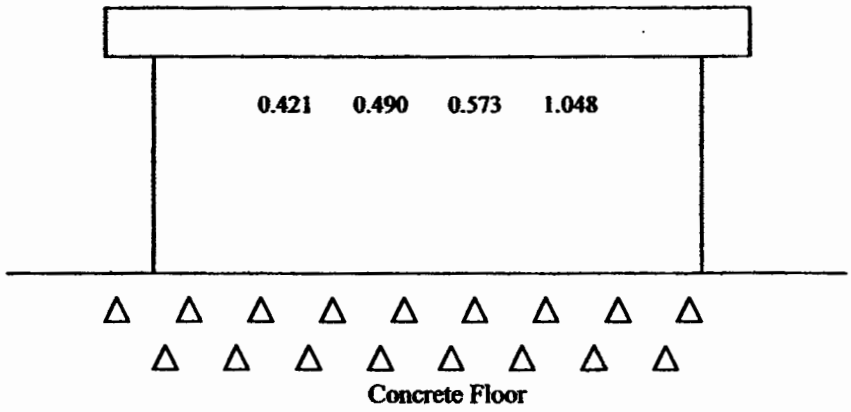


(facing pipe from pump side)

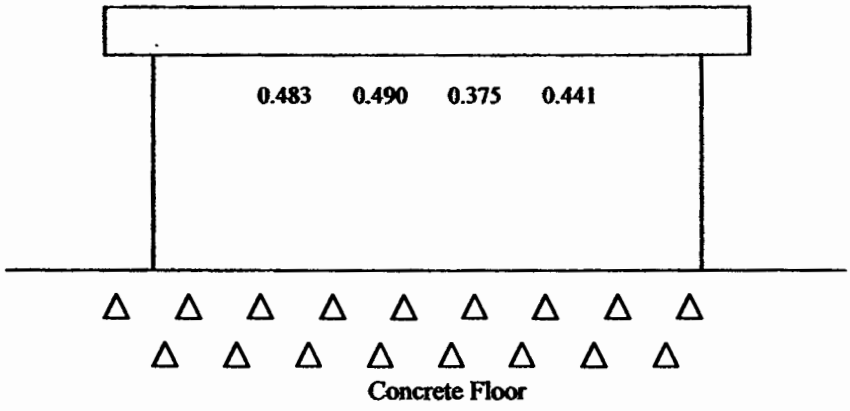
Notes: _____

Canadian Structural Inspection Services Ltd.	W.O. #	Pages: 1 of 1
	File # 4867	Date: January 27, 2005
	Technician: C.W.	Helper: S.Q.
Station & Pump No. Jesse #107	Pipe Diameter:	
Description: NDT U.T. Wall Thickness Determinations on Flood Pump Discharge Pipes Before Pump		

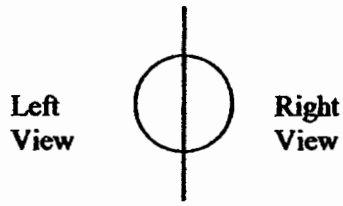
* Readings listed below in thousandths of an inch or decimal inches



LEFT



RIGHT



(looking down from top of pipe flange)

Notes: Pump Casing Readings: (Larger Diameter to Smaller Diameter on Casing)

Location #1 – 0.898"

Location #2 – 1.054"

Location #3 – 0.869"

Location #4 – 1.163"

- 3" only of pipe accessible only took 1 reading per location.

APPENDIX F

ITE BREAKER INVESTIGATION

City of Winnipeg LV Breaker Assessment

Equipment:	ITE KA and KB 600V Air Circuit Breaker
Location:	Various
Date:	January 15, 2007

Prepared by:

Fred Arnold, C.E.T.
ABB Power Apparatus Service
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Winnipeg, Manitoba R3Y 1G4
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Prepared for:

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Winnipeg, Manitoba, Canada. R3T 5P4
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Fax: 204-896-0754

Summary

City of Winnipeg personnel delivered three ITE 600V circuit breakers for condition assessment in December 2006. The information for each breaker is listed below.

Breaker serial	**E-964**
Breaker Model	KA
Voltage Class	600 V
Current Rating	225 A
Short Circuit Rating	15 kA
Frequency	60 Hz
Date of Manu.	4/51

Breaker serial	**E-828**
Breaker Model	KA
Voltage Class	600 V
Current Rating	225 A
Short Circuit Rating	15 kA
Frequency	60 Hz
Date of Manu.	4/51

Breaker serial	**31749**
Breaker Model	KB-2
Voltage Class	600 V
Current Rating	220 A
Short Circuit Rating	25 kA
Frequency	60 Hz
Date of Manu.	3/61

The breakers were inspected and operated to determine physical condition.

Although these breakers are vintage design, the wear on the individual breakers is not significant. All three breakers were found in good physical condition. Some items, however, were found defective and are detailed in the Appendix. The most significant of these were the disabling of the under-voltage devices, later determined as non-functional, a lack of lubrication on moving parts and several small leaks of dashpot oil from both the under-voltage trip devices and the current limiting trip devices.

The breakers were electrically tested to determine operability.

Again, overall the breakers are in good condition for their age, however, one breaker, serial # E-964, is not tripping in the proper range and all three breaker under-voltage trip devices are non-functional.

Conclusion

The overall objective of this assessment is to determine if the above models of breaker can operate at and under the condition of their original design. It is obvious that these breakers have not seen an excessive amount of duty in their service life. It is also obvious that they have not seen regular routine maintenance/testing, at least in the latter part of their service life.

Based on the findings of this assessment, these breakers, in their current condition would not operate to their design potential.

There is some remedial work required to make these breakers suitable for extended service life. Each would require an overhaul of the mechanism, which would include dismantling, cleaning, lubrication and replacement of excessively worn parts (assumed to be minimal based on condition). The requirement of an under-voltage trip device should be determined and these devices replaced or removed based on this decision. Further, the non functioning unit should be converted to a solid-state trip device.

For the remaining fleet of breakers, the following minimum recommendations would apply:

- Inspection and testing similar to this project for each unit in service.
- Overhaul of mechanism, as above.
- Determination of need of under-voltage trip device.

As a further recommendation, it would be prudent to replace all the trip devices with solid state units. The benefits include:

- Increased select ability of trip settings.
- Ease of testing.
- Increased reliability.

Another option for increased reliability and serviceability would be a systematic replacement with new breakers, utilizing modern technology, modified to fit in the existing switchgear. This may be a viable option given the age of the existing breakers and the availability of parts.

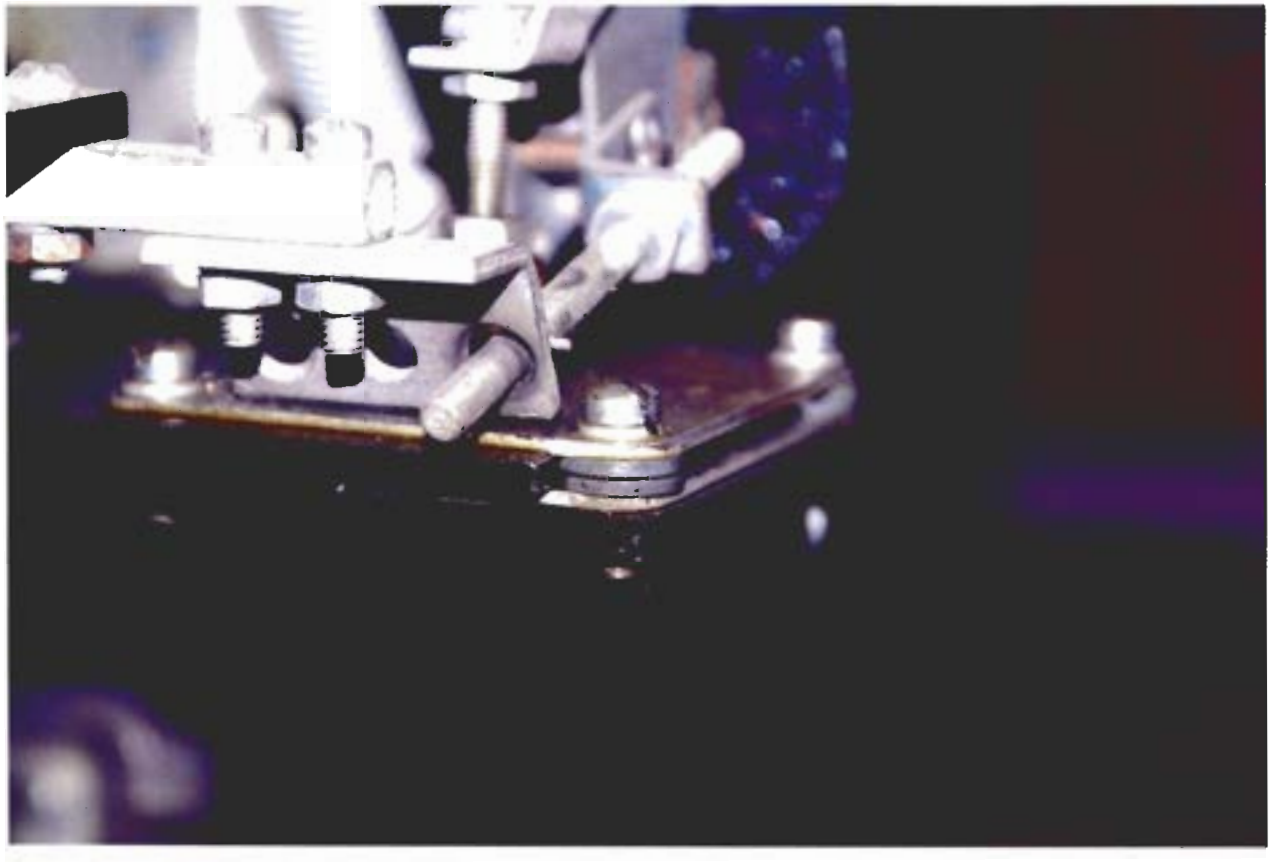
Any or all of these options are available through ABB, and we would be pleased to offer these services in the future.

Appendix

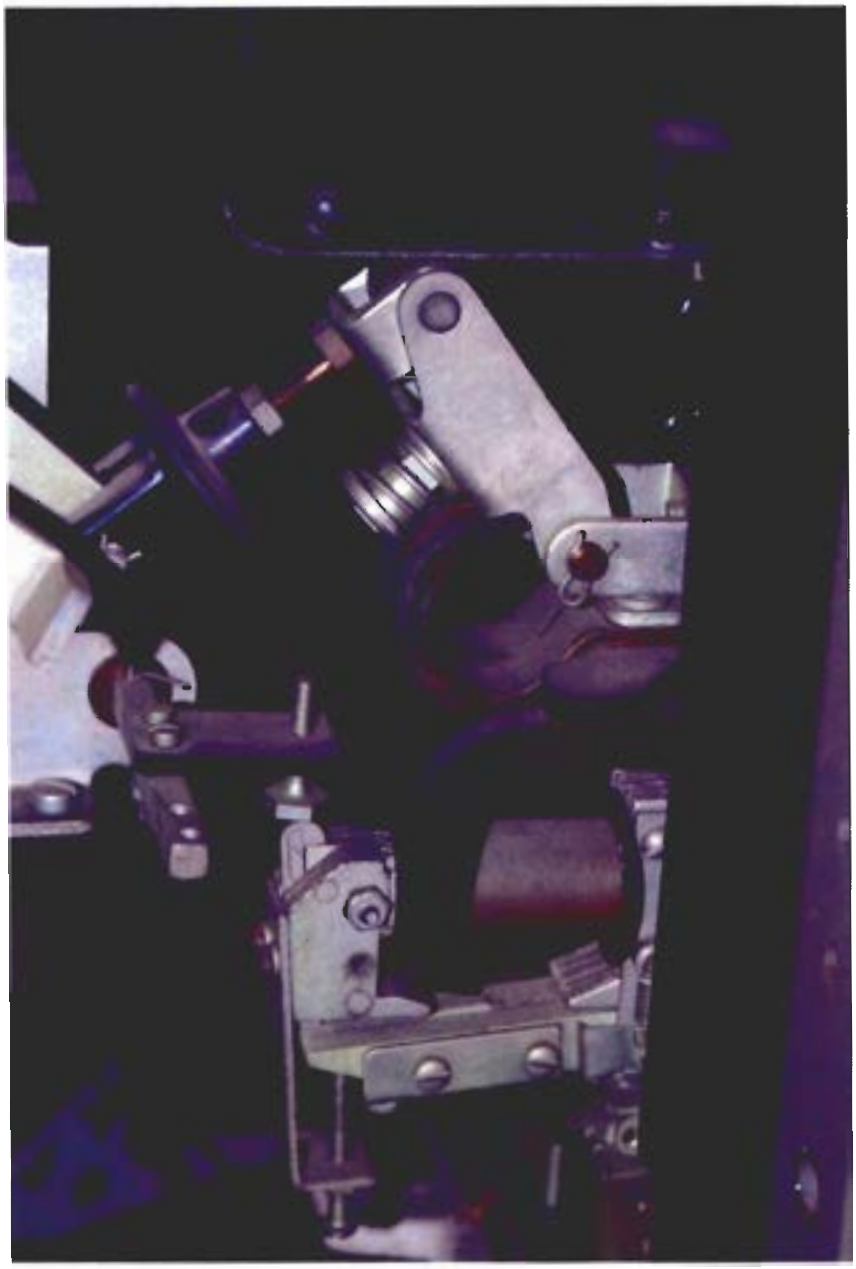
E-964:



Disabling of non-functional under-voltage trip device.



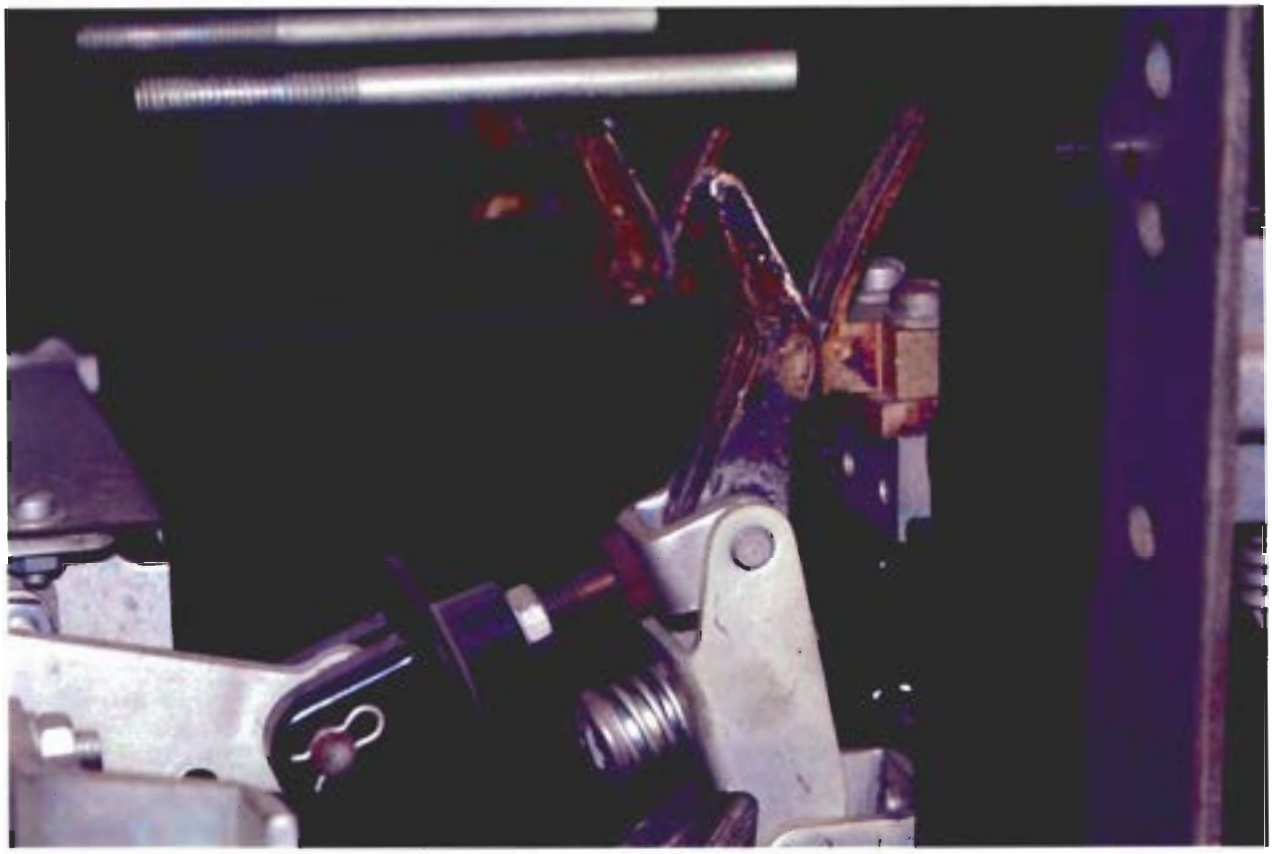
Evidence of leaking dashpot oil on C phase of breaker.



Dust and dirt collecting on breaker and a visual lack of lubrication on any moving part, some environmental degradation (rust) on breaker parts.



Contacts are dirty, but overall in very good condition.



Contact pressure and alignment is satisfactory.



Primary disconnects are dirty, but overall in good condition.

CIRCUIT BREAKER PROTECTION DEVICE

Customer:		Customer P.O. #:		Job #:	
Tested by:	D. Tran	Date:	Dec 12/06	Relay Serial #:	N/A
Location:	ABB Edmonton	Position:	N/A	Manufacturer:	ITE
Breaker Type:	KA	Breaker Serial #:	E-964	Model:	N/A
Cat. #:	N/A	Type:	N/A	Frequency:	60Hz
Sensor Type:	Direct-Acting	Sensor Ratio:	N/A		

Primary Injection: ☒ Secondary Injection: ☐
Acceptance Testing: ☐ Maintenance Testing: ☒

SETTINGS

			As Found		As Left	
	Rated Current	Tap Setting	Pickup	Delay	Pickup	Delay
Long Time	N/A	N/A	N/A	N/A	N/A	N/A
Short Time	N/A	N/A	N/A	N/A	N/A	N/A
Instantaneous	225A	1000	1000	Inst.	1000	Inst.
Ground Fault	N/A	N/A	N/A	N/A	N/A	N/A

ELECTRICAL TESTS

		Rated Current	Tap Setting	Pickup Tests in Amps			Timing Tests in Seconds				
				As Found	As Left	Expected	Multiply Pickup	Equiv. Amps	Time Found	Time Left	Time Expected
Long Time	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Short Time	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Instantaneous	A	225	1000	1400	1400	1000	150%	1500	Inst	Inst	Inst
	B	225	1000	1300	1300	1000	150%	1500	Inst	Inst	Inst
	C	225	1000	1500	1500	1000	150%	1500	Inst	Inst	Inst
Ground		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test Equipment Used: ETI High Current Test Unit Allowable % Error: +/- 30
Coordination Reference: ITE Time-Overcurrent Chracteristics

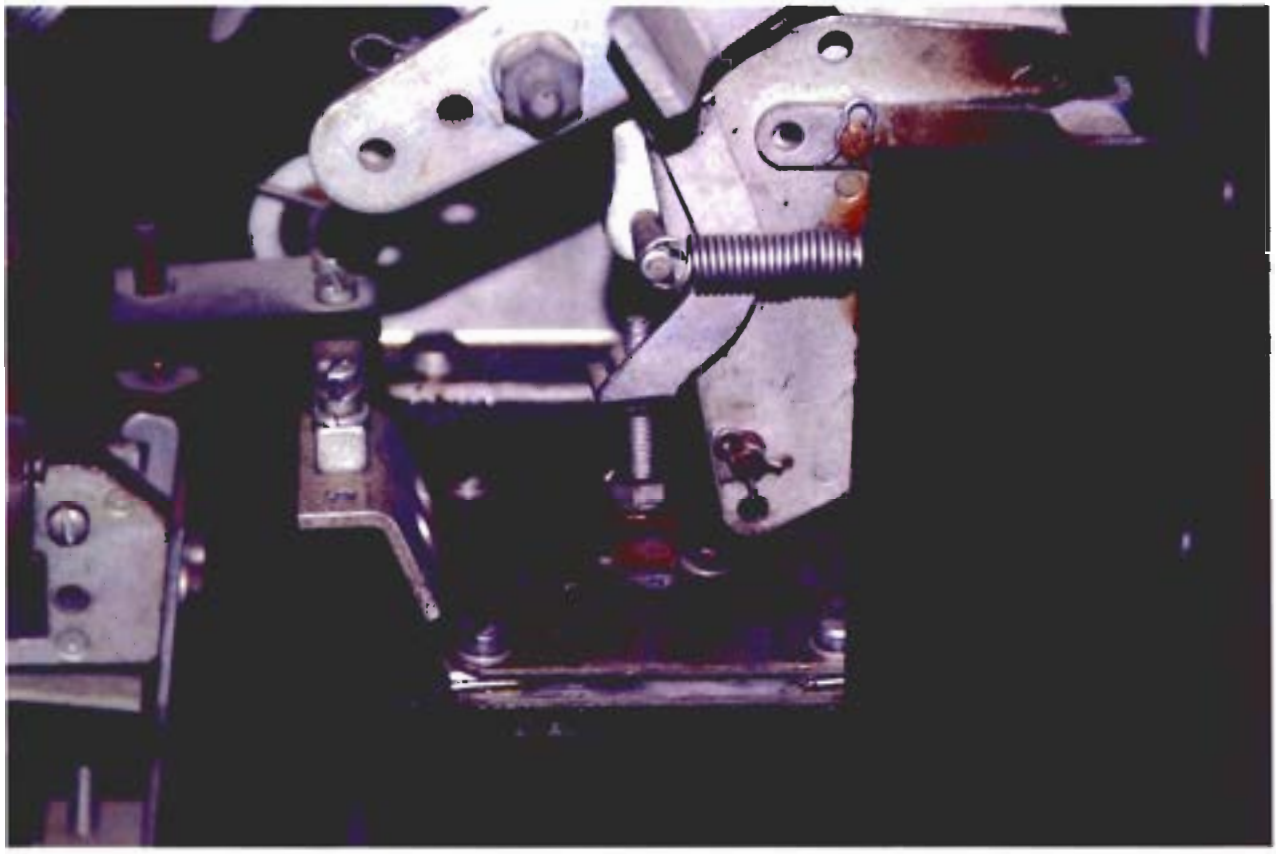
INDICATORS / TARGETS

	Pickup			Trip		
	Pass	Fail	N/A	Pass	Fail	N/A
Long Time			√			√
Short Time			√			√
Instantaneous		√			√	
Ground Fault			√			√

COMMENTS:
This breaker equiped with Instantanous Direct-Acting Trips and Undervoltage Release for protections
Undervoltage Release is no longer function

This equipment was inspected/tested according to NETA ATS/MTS and manufacturer's specifications and found ____ suitable for placing in service.

E-828



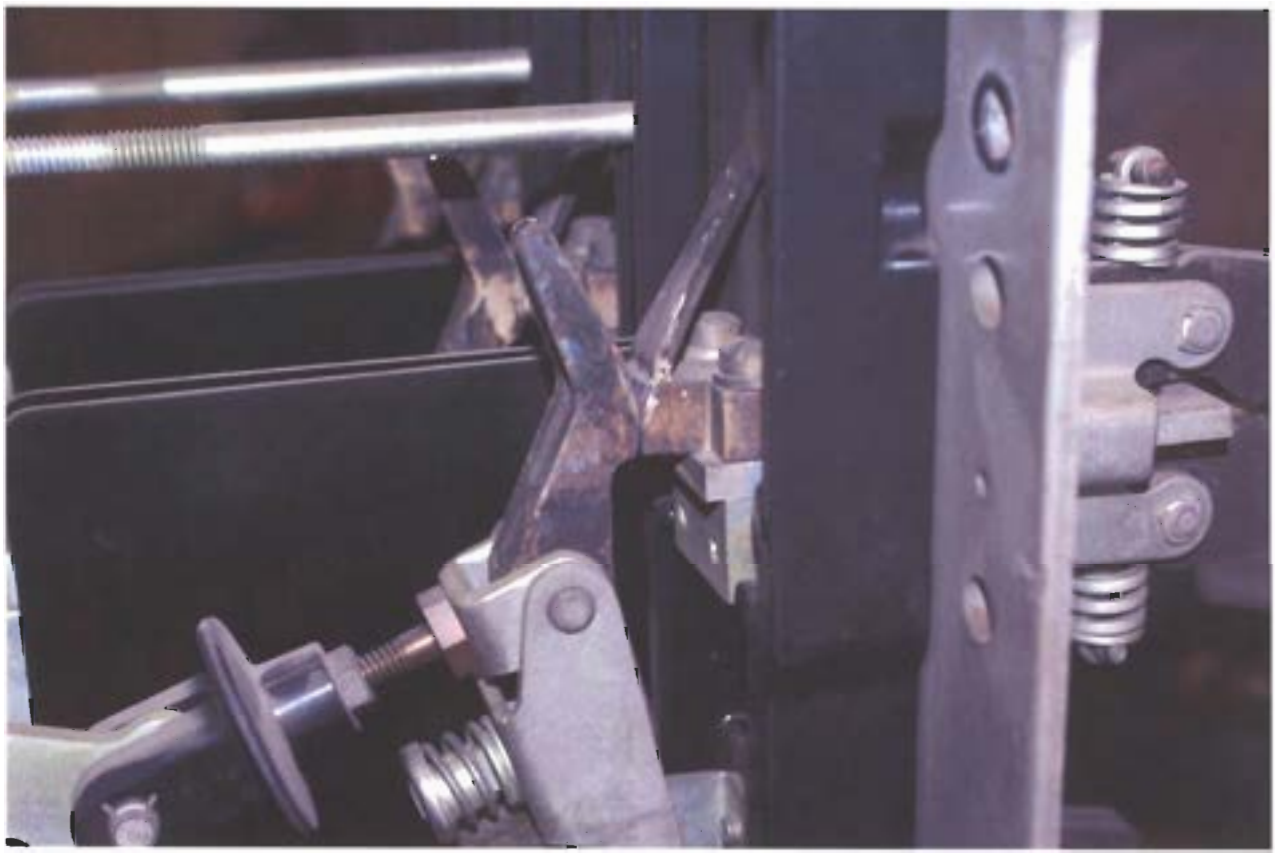
Evidence of leaking dashpot on C phase.



Lubrication deficiency on moving parts.



Contact condition is good, but cleaning is required.



Contact alignment and pressure is satisfactory.



Primary disconnects dirty, but in good condition.

CIRCUIT BREAKER PROTECTION DEVICE

Customer:		Customer P.O. #:		Job #:	
Tested by:	D. Tran	Date:	Dec 12/06	Relay Serial #:	N/A
Location:	ABB Edmonton	Position:	N/A	Manufacturer:	ITE
Breaker Type:	KA	Breaker Serial #:	E-828	Model:	N/A
Cat. #:	N/A	Type:	N/A	Frequency:	60Hz
Sensor Type:	Direct-Acting	Sensor Ratio:	N/A		

Primary Injection: ☒ Secondary Injection: ☐
Acceptance Testing: ☐ Maintenance Testing: ☒

SETTINGS

			As Found		As Left	
	Rated Current	Tap Setting	Pickup	Delay	Pickup	Delay
Long Time	N/A	N/A	N/A	N/A	N/A	N/A
Short Time	N/A	N/A	N/A	N/A	N/A	N/A
Instantaneous	225A	800	800	Inst.	800	Inst.
Ground Fault	N/A	N/A	N/A	N/A	N/A	N/A

ELECTRICAL TESTS

		Rated Current	Tap Setting	Pickup Tests in Amps			Timing Tests in Seconds				
				As Found	As Left	Expected	Multiply Pickup	Equiv. Amps	Time Found	Time Left	Time Expected
Long Time	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Short Time	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Instantaneous	A	225	800	790	790	800	120%	960	Inst	Inst	Inst
	B	225	800	860	860	800	120%	960	Inst	Inst	Inst
	C	225	800	840	840	800	120%	960	Inst	Inst	Inst
Ground		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test Equipment Used: ETI High Current Test Unit Allowable % Error: +/- 30
Coordination Reference: ITE Time-Overcurrent Chracteristics

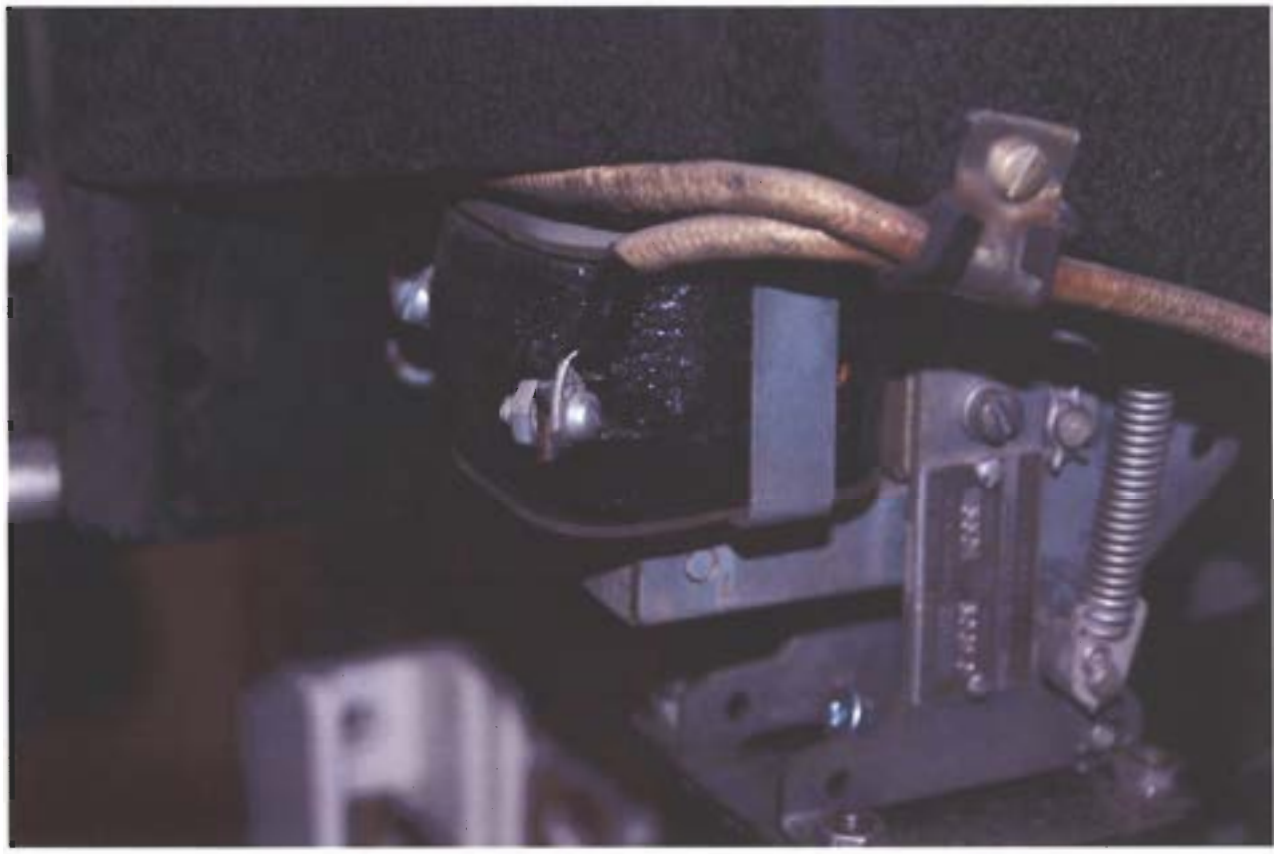
INDICATORS / TARGETS

	Pickup			Trip		
	Pass	Fail	N/A	Pass	Fail	N/A
Long Time			√			√
Short Time			√			√
Instantaneous	√			√		
Ground Fault			√			√

COMMENTS:
This breaker equiped with Instantanous Direct-Acting Trips and Undervoltage Release for protections
Undervoltage Release is no longer function

This equipment was inspected/tested according to NETA ATS/MTS and manufacturer's specifications and found ____ suitable for placing in service.

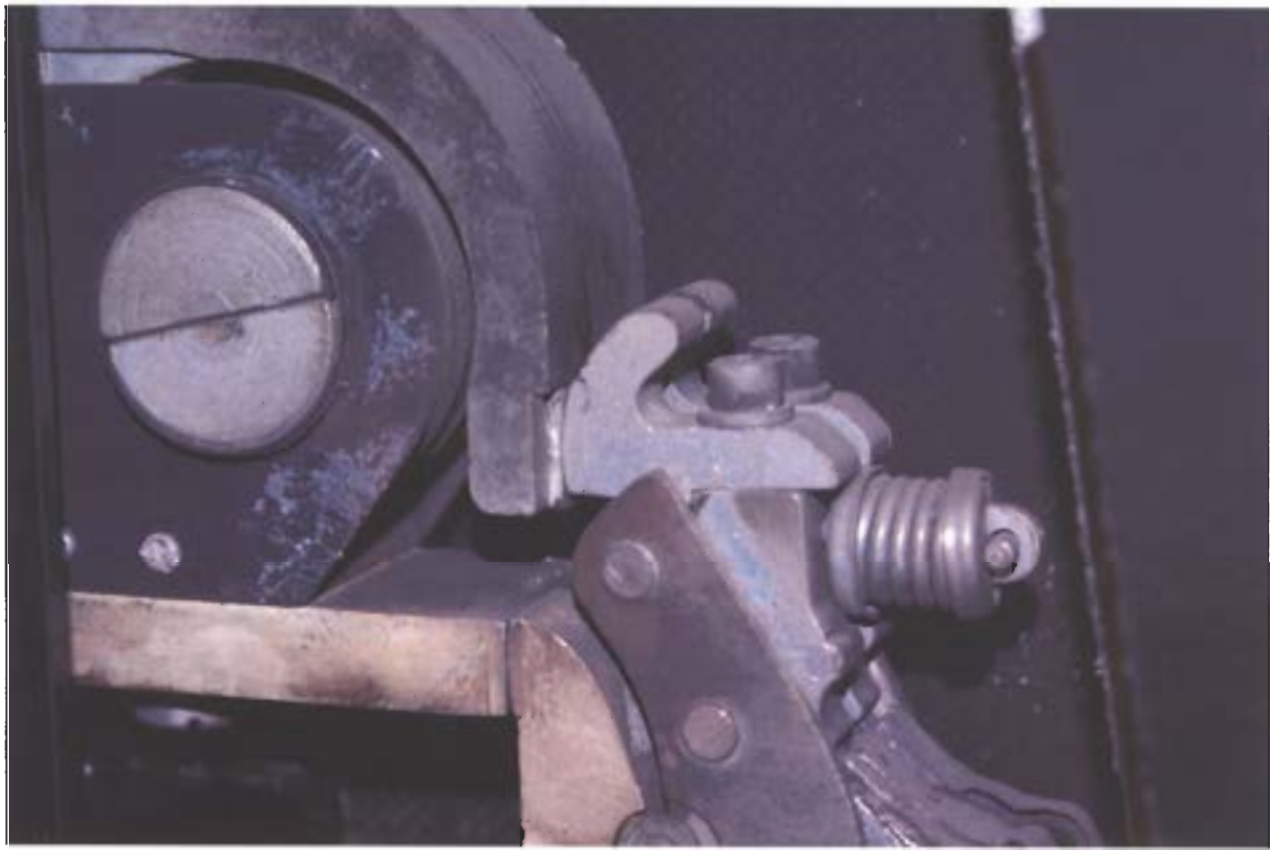
31749:



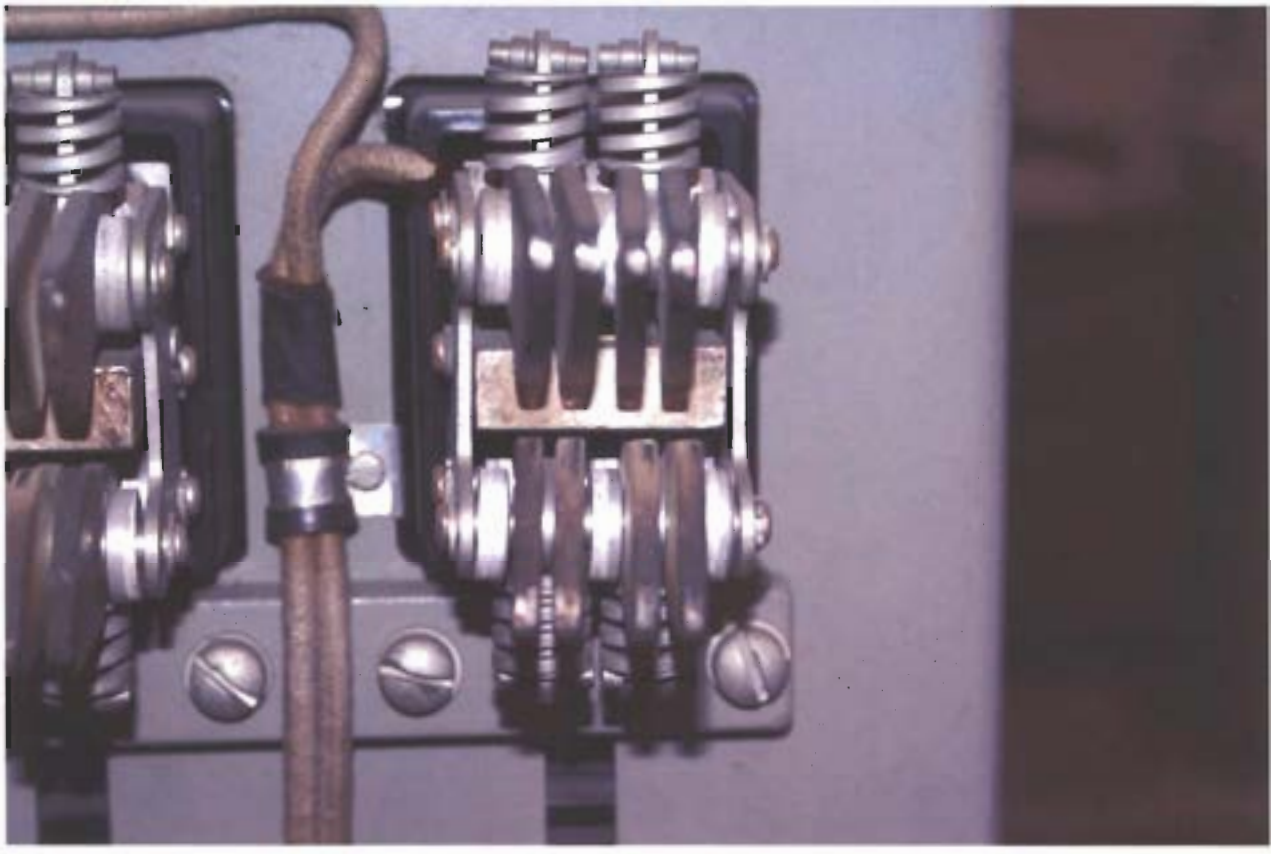
Non- functional under-voltage trip device coil showing evidence of overheating.



Main contact assemblies in good condition.



Contact alignment and pressure is satisfactory.



Primary disconnects in good condition.

CIRCUIT BREAKER PROTECTION DEVICE

Customer:		Customer P.O. #:		Job #:	
Tested by:	D. Tran	Date:	Dec 12/06	Relay Serial #:	N/A
Location:	ABB Edmonton	Position:	N/A	Manufacturer:	ITE
Breaker Type:	KB-2	Breaker Serial #:	31749	Model:	N/A
Cat. #:	N/A	Type:	N/A	Frequency:	60Hz
Sensor Type:	Direct-Acting	Sensor Ratio:	N/A		

Primary Injection: ☒ Secondary Injection: ☐
Acceptance Testing: ☐ Maintenance Testing: ☒

SETTINGS

			As Found		As Left	
	Rated Current	Tap Setting	Pickup	Delay	Pickup	Delay
Long Time	N/A	N/A	N/A	N/A	N/A	N/A
Short Time	N/A	N/A	N/A	N/A	N/A	N/A
Instantaneous	220A	1470	1470	Inst.	1470	Inst.
Ground Fault	N/A	N/A	N/A	N/A	N/A	N/A

ELECTRICAL TESTS

		Rated Current	Tap Setting	Pickup Tests in Amps			Timing Tests in Seconds				
				As Found	As Left	Expected	Multiply Pickup	Equiv. Amps	Time Found	Time Left	Time Expected
Long Time	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Short Time	A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	B	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	C	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Instantaneous	A	220	1470	1500	1500	1470	120%	1760	Inst	Inst	Inst
	B	220	1470	1650	1650	1470	120%	1760	Inst	Inst	Inst
	C	220	1470	1800	1800	1470	120%	1760	Inst	Inst	Inst
Ground		N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Test Equipment Used: ETI High Current Test Unit Allowable % Error: +/- 30
Coordination Reference: ITE Time-Overcurrent Chracteristics

INDICATORS / TARGETS

	Pickup			Trip		
	Pass	Fail	N/A	Pass	Fail	N/A
Long Time			√			√
Short Time			√			√
Instantaneous	√			√		
Ground Fault			√			√

COMMENTS:
This breaker equiped with Instantanous Direct-Acting Trips and Undervoltage Release for protections
Undervoltage Release is no longer function

PROPERTY
OF THE
WATER & WASTE DEPARTMENT
RESOURCE CENTRE
109 - 1199 PACIFIC AVE.

This equipment was inspected/tested according to NETA ATS/MTS and manufacturer's specifications and found suitable for placing in service