

# **PART E**

# **SPECIFICATIONS**

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## Part 1 General

### 1.1 SCOPE OF WORK SUMMARY

- .1 Scope of work includes materials and installation requirements for rehabilitation of the three Return Activated Sludge (RAS) train piping systems located in the Secondary Clarifier Building at the North End Sewage Treatment Plant (also known as NEWPCC) in Winnipeg, MB as detailed on the drawings and specifications and as summarized herein. Rehabilitation will include the following work to be performed on discrete segments of the piping systems, as outlined further in this section:
  - .1 Repair of piping with carbon fiber reinforced plastic (CFRP) composite external wrap.
  - .2 Replacement of RAS piping, valves and flowmeters where indicated.
  - .3 Replacement of WAS piping, valves and flowmeters where indicated
  
- .2 Repair of piping with CFRP external wrap will include the following:
  - .1 450 mm diameter (DN450) piping from outlets of Secondary Clarifiers 11 to 18 (RAS train 2) and Secondary Clarifiers 19 to 26 (RAS Train 3). Piping is to be wrapped from the Clarifier outlet pipe wall penetration flanges up to the flanges of the nearest downstream manual isolation valves.
  - .2 RAS train 1 header piping, sizes ranging from DN300 to DN900, up to the flanges of manual isolation valves R810-KV-1A and R815-KV-1B at the high purity oxygen (HPO) reactors. Header piping includes all branch connections to the header, up to the flanges of the branch isolation valves.
  - .3 RAS train 2 header piping, sizes ranging from DN300 to DN900, up to the flanges of manual isolation valves R820-KV-2A and R825-KV-2B at the high purity oxygen (HPO) reactors. Header piping includes all branch connections to the header, up to the flanges of the branch isolation valves.
  - .4 RAS train 3 header piping, sizes ranging from DN300 to DN900, up to the flanges of manual isolation valves R830-KV-3A and R835-KV-3B at the high purity oxygen (HPO) reactors. Header piping includes all branch connections to the header, up to the flanges of the branch isolation valves.
  - .5 WAS pumps common discharge header, size DN300, from existing WAS pump discharge valves S951-HV4-1, S952-HV4-2, S953-HV4-3 and S954-HV4-4, to the first DN300 flange on the header.
  - .6 In cases where pipe rests upon existing steel supports, provide new pipe supports and remove existing pipe supports as needed to perform installation of the CFRP wrap. New pipe supports shall be put in place prior to removal of existing supports, so that the extent of piping support meets or exceeds the current level of support at all times, and does not create undue additional loads and stresses in the piping. The Contractor shall propose a methodology and sequencing of this work in coordination with the CFRP wrap installation. It is anticipated the general sequencing will involve:
    - .1 Installation of CFRP wrap on intermediate sections of piping between existing supports;
    - .2 Installation of new pipe supports on sections of completed CFRP wrap to either side of existing supports;
    - .3 Removal of existing supports and completion of CFRP wrap.

- .7 In cases where piping is supported on concrete saddles, or where steel support attachments are welded to pipe, the CFRP wrap will extend onto the support structure and terminate a suitable distance from the pipe. This will encapsulate a portion of the attached support structure together with the piping.
- .8 Existing small-diameter valves (DN50 or less) for low-point drain (LPD) and high point vent valve (HPV) shall be fully encapsulated in the CFRP wrap. Prior to application of the wrap, new LPD and HPV valves shall be installed on the RAS piping by hot-tap installation on the in-service piping. Prior to hot tapping, the Contractor shall perform NDE to verify that sufficient pipe wall thickness exists at the proposed hot-tap location.
- .3 Replacement of RAS piping, valves and flowmeters will include the following:
  - .1 Replace DN500 manual knife-gate isolation valves on the RAS inlets to the HPO reactors, including:
    - .1 Valves R810-KV-1A and R815-KV-1B on RAS train 1.
    - .2 Valves R820-KV-2A and R825-KV-2B on RAS train 2.
    - .3 Valves R830-KV-3A and R835-KV-3B on RAS train 3.
  - .2 Replace DN500 piping downstream of above valves, to flanged connection at HPO reactor inlets.
  - .3 Replace flowmeters in above piping, including:
    - .1 R810-FE and R815-FE on RAS train 1.
    - .2 R820-FE and R825-FE on RAS train 2.
    - .3 R830-FE and R835-FE on RAS train 3.
- .4 Replacement of WAS piping, valves and flowmeters will include the following:
  - .1 Addition of new DN250 manual knife-gate isolation valves on the WAS lines 1, 2, and 3.
  - .2 Replace DN250 carbon steel piping.
  - .3 Replace flowmeters in above piping, including:
    - .1 S941-FE (S941-FG and S941-FIT) on WAS train 3.
    - .2 S942-FE (S942-FG and S942-FIT) on WAS train 2.
    - .3 S943-FE (S943-FG and S943-FIT) on WAS train 1.
- .5 Existing paint coatings on RAS piping have been confirmed to contain lead. The Contractor shall perform lead abatement for any operations that involve removal of paint coatings for surface preparation or other purpose on existing RAS or WAS piping.

## 1.2 WORK SEQUENCE

- .1 Construct Work in stages to accommodate The City's continued use of premises during construction.
- .2 Maintain fire access/control.

## 1.3 CONTRACTOR'S USE OF PREMISES

- .1 Limit use of premises for storage, for Work, for access, to allow:
  - .1 City occupancy.
- .2 Co-ordinate use of premises under direction of Contract Administrator.
- .3 Obtain and pay for use of additional storage or work areas needed for operations under this Contract.

- .4 Remove or alter existing work to prevent injury or damage to portions of existing work which remain.
- .5 Repair or replace portions of existing work which have been altered during construction operations to match existing or adjoining work, as directed by Contract Administrator.
- .6 At completion of operations condition of existing work: equal to or better than that which existed before new work started.

#### **1.4 OCCUPANCY**

- .1 The City will occupy premises during entire construction period for execution of normal operations.
- .2 Co-operate with the City in scheduling operations to minimize conflict and to facilitate the City usage.

#### **1.5 EXISTING SERVICES**

- .1 Notify, Contract Administrator and utility companies of intended interruption of services and obtain required permission.
- .2 Where Work involves breaking into or connecting to existing services, give 2 weeks notice for necessary interruption of mechanical or electrical service throughout course of work. Minimize duration of interruptions. Carry out work at times as directed by governing authorities with minimum disturbance to City operations.
- .3 Provide alternative routes for personnel.
- .4 Establish location and extent of service lines in area of work before starting Work. Notify Contract Administrator of findings.
- .5 Submit schedule to and obtain approval from Contract Administrator for any shut-down or closure of active service or facility including power and communications services. Adhere to approved schedule and provide notice to affected parties.
- .6 Provide temporary services when directed by Contract Administrator to maintain critical building systems.
- .7 Where unknown services are encountered, immediately advise Contract Administrator and confirm findings in writing.
- .8 Protect, relocate or maintain existing active services. When inactive services are encountered, cap off in manner approved by authorities having jurisdiction.
- .9 Record locations of maintained, re-routed and abandoned service lines.

#### **1.6 DOCUMENTS REQUIRED**

- .1 Maintain at job site, one copy each document as follows:
    - .1 Contract Drawings.
    - .2 Specifications.
    - .3 Addenda.
    - .4 Reviewed Shop Drawings.
    - .5 List of Outstanding Shop Drawings.
    - .6 Change Orders.
    - .7 Other Modifications to Contract.
    - .8 Field Test Reports.
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- .9 Copy of Approved Work Schedule.
- .10 Health and Safety Plan and Other Safety Related Documents.
- .11 Other documents as specified.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

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**Part 1            General**

**1.1            SCOPE OF WORK**

- .1 Contractor shall schedule and coordinate the following meetings with the Contract Administrator, as required:
  - .1 Pre-construction meeting.
  - .2 Bi-weekly construction progress meetings throughout the presence on site until Total Performance. Allow for weekly meeting for the first two months of the project.
  - .3 Commissioning Meetings prior to and during all commissioning activities.
- .2 The purpose of these meetings is to review personnel assignments, responsibilities, administrative and procedural requirements and to obtain updates on construction and commissioning progress.
- .3 Contractor's Project Manager shall be responsible to chair the meetings and minutes. The minutes shall be distributed within 3 working days from the date of the meeting.
- .4 Contractor shall also coordinate location, attendees, and agenda with the Contract Administrator.
- .5 The bi-weekly construction meetings shall be attended by the Contractor's Project Manager, Site Superintendent, Subcontractor leads and any technical experts that are required to communicate the Construction and overall management of activities to the Contract Administrator.

**1.2            ADMINISTRATIVE**

- .1 Schedule and administer project meetings throughout the progress of the Work.
- .2 Prepare agenda for meetings.
- .3 Distribute written notice of each meeting five working days in advance of meeting date to Contract Administrator.
- .4 Provide physical space and make arrangements for meetings.
- .5 Preside at meetings.
- .6 Record the meeting minutes. Include significant proceedings and decisions. Identify actions by parties.
- .7 Reproduce and distribute copies of minutes within three working days after meetings and transmit to meeting participants and, affected parties not in attendance.
- .8 Representative of Contractor, Subcontractors and suppliers attending meetings will be qualified and authorized to act on behalf of party each represents.
- .9 Allow provisions for some City staff to attend the meetings virtually via MS Teams.

**1.3            PRECONSTRUCTION MEETING**

- .1 Within 15 days after award of Contract, request a meeting of parties in contract to discuss and resolve administrative procedures and responsibilities.
  - .2 Contract Administrator, Contractor, major Subcontractors, field inspectors and supervisors will be in attendance.
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- .3 Establish time and location of meeting and notify parties concerned minimum 5 days before meeting.
- .4 Agenda to include:
  - .1 Appointment of official representative of participants in the Work.
  - .2 Schedule of Work: in accordance with 01 32 16.06- Construction Progress Schedule - Critical Path Method (CPM).
  - .3 Schedule of submission of shop drawings, samples, colour chips. Submit submittals in accordance with Section 01 33 00- Submittal Procedures.
  - .4 Requirements for temporary facilities, site sign, offices, storage sheds, utilities, fences in accordance with Section 01 52 00- Construction Facilities.
  - .5 Site security in accordance with Section 01 56 00- Temporary Barriers and Enclosures.
  - .6 Proposed changes, change orders, procedures, approvals required, mark-up percentages permitted, time extensions, overtime, administrative requirements.
  - .7 Record drawings in accordance with Section 01 33 00- Submittal Procedures.
  - .8 Maintenance manuals in accordance with Section 01 78 00- Closeout Submittals.
  - .9 Take-over procedures, acceptance, warranties in accordance with Section 01 78 00- Closeout Submittals.
  - .10 Monthly progress claims, administrative procedures, photographs, hold backs.
  - .11 Appointment of inspection and testing agencies or firms.
  - .12 Insurances, transcript of policies.

#### **1.4 PROGRESS MEETINGS**

- .1 During course of Work and bi-weekly.
  - .2 Contractor, major Subcontractors involved in Work and Contract Administrator are to be in attendance.
  - .3 Notify parties minimum 5 working days prior to the meeting.
  - .4 Record minutes of meetings and circulate to attending parties and affected parties not in attendance within 3 working days.
  - .5 Agenda to include the following:
    - .1 Review, approval of minutes of previous meeting.
    - .2 Review of Work progress since previous meeting.
    - .3 Field observations, problems, conflicts.
    - .4 Problems which impede construction schedule.
    - .5 Review of off-site fabrication delivery schedules.
    - .6 Corrective measures and procedures to regain projected schedule.
    - .7 Revision to construction schedule.
    - .8 Progress schedule, during succeeding work period.
    - .9 Review submittal schedules: expedite as required.
    - .10 Maintenance of quality standards.
    - .11 Review proposed changes for affect on construction schedule and on completion date.
    - .12 Other business.
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**Part 2            Products**

**2.1                NOT USED**

.1            Not Used.

**Part 3            Execution**

**3.1                NOT USED**

.1            Not Used.

**END OF SECTION**

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**Part 1            General****1.1                SCOPE OF WORK**

- .1     The scope of work includes the following as detailed herein:
  - .1     Project master schedule
    - .1     Include key shutdown dates
  - .2     Project detail schedule, updated bi-weekly, with minimum one month look ahead.

**1.2                REFERENCE STANDARDS**

- .1     Project Management Institute (PMI Standards)
  - .1     A Guide to the Project Management Body of Knowledge (PMBOK Guide) – Latest Edition.
  - .2     Practice Standard for Scheduling - 2011.

**1.3                DEFINITIONS**

- .1     Activity: element of Work performed during course of Project. Activity normally has expected duration, and expected cost and expected resource requirements. Activities can be subdivided into tasks.
  - .2     Bar Chart (Gantt chart): graphic display of schedule-related information. In typical bar chart, activities or other Project elements are listed down left side of chart, dates are shown across top, and activity durations are shown as date-placed horizontal bars.
  - .3     Baseline: original approved plan (for Project, work package, or activity), plus or minus approved scope changes.
  - .4     Cash Flow: projection of progress payment requests based on cash loaded construction schedule.
  - .5     Completion Milestones: they are firstly Substantial Completion and secondly Total Performance Certificate.
  - .6     Constraint: applicable restriction or limitation, either internal or external to project, that will affect performance of Project. Factors that affect activities can be scheduled.
  - .7     Control: process of comparing actual performance with planned performance, analyzing variances, evaluating possible alternatives, and taking appropriate corrective action as needed.
  - .8     Critical Activity: any activity on a critical path.
    - .1     Most commonly determined by using critical path method.
  - .9     Critical Path: sequence of activities that determines duration of Project. Generally, it is the longest path through Project.
    - .1     Usually defined as those activities with float less than or equal to specified value, often zero.
  - .10    Critical Path Method (CPM): network analysis technique used to determine the amount of scheduling flexibility (amount of float) on various logical network paths in Project schedule network, and to determine the minimum total Project duration.
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- .11 Data Date: date through which project status and progress were last determined and reported for analyses, such as scheduling and performance measurements.
  - .12 Duration: total number of work periods (not including holidays or other non-working periods) required to complete activity or another Project element.
    - .1 Usually expressed as workdays or work weeks.
  - .13 Early Finish Date: in critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can finish, based on network logic and schedule constraints.
    - .1 Early finish dates can change as Project progresses and changes are made to Project plan.
  - .14 Early Start Date: in critical path method, earliest possible point in time on which uncompleted portions of activity (or Project) can start, based on network logic and schedule constraints.
    - .1 Early start dates can change as Project progresses and changes are made to Project Plan.
  - .15 Finish Date: point in time associated with activity's completion.
    - .1 Usually qualified by one of following: actual, planned, estimated, scheduled, early, late, baseline, target, or current.
  - .16 Float: amount of time that activity may be delayed from its early start without delaying Project finish date.
    - .1 This resource is available to both Contract Administrator and Contractor.
  - .17 Impact Analysis: schedule analysis technique that adds a modeled delay to an accepted construction schedule to determined possible outcome of that delay on project completion.
  - .18 Lag: modification of logical relationship that directs delay in successor activity.
  - .19 Late Finish Date (LF): in critical path method, latest possible point in time that activity may be completed without delaying specified milestone (usually Project finish date).
  - .20 Late Start Date (LS): in critical path method, latest possible point in time that activity may begin without delaying specified milestone (usually Project finish date).
  - .21 Lead: modification of logical relationship that allows acceleration of successor task.
  - .22 Logic Diagram: see Project network diagram.
  - .23 Master Schedule: summary-level schedule that identifies major deliverable; work breakdown structure and key milestones.
  - .24 Milestone: significant point or event in Project, usually completion of major deliverable.
  - .25 Monitoring: capture, analysis, and reporting of Project performance, usually as compared to plan.
  - .26 Non-Critical Activities: activities which when delayed, do not affect specified Contract duration.
  - .27 Project Control System: fully computerized system utilizing commercially available software packages.
  - .28 Project Network Diagram: schematic display of logical relationships of Project activities.
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- .1 Always drawn from left to right to reflect Project chronology.
- .29 Project Plan: formal, approved document used to guide both Project execution and Project control.
  - .1 Primary uses of Project plan are to document planning assumptions and decisions, facilitate communication among stakeholders, and document approved scope, cost, and schedule baselines.
  - .2 Project plan may be summary or detailed.
- .30 Project Planning: development and maintenance of Project Plan.
- .31 Project Planning, Monitoring and Control System: overall system operated to enable monitoring of Project Work in relation to established milestones.
- .32 Project Schedule: planned dates for performing activities and planned dates for meeting milestones.
- .33 Quantified days duration: working days based on 5-day work week, discounting statutory holidays.
- .34 Risk: uncertain event or condition that, if it occurs, has positive or negative effect on Project's objectives.
- .35 Start Date: point in time associated with activity's start, usually qualified by one of following: actual, planned, estimated, scheduled, early, late, target, baseline, or current.
- .36 Work Breakdown Structure (WBS): deliverable-oriented hierarchical decomposition of Work to be executed by contractor to accomplish project objectives and create required deliverables. It organizes and defines total scope of Project. Each descending level represents an increasingly detailed definition of Project Work. WBS is decomposed into Work packages.

#### 1.4 ADMINISTRATIVE REQUIREMENTS

- .1 Project Meeting:
  - .1 Participate in regular project progress meetings with Contract Administrator specifically intended to discuss update of detailed schedule and contract changes.
- .2 Scheduling:
  - .1 Planning: ensure that planning process is iterative and results in generally top-down processing with more detail being developed as planning progresses, and decisions concerning options and alternatives are made.
  - .2 Ensure project schedule efficiencies through monitoring of Project in detail to ensure integrity of Critical Path, by comparing actual completions of individual activities with their scheduled completions, and review progress of activities that has started but are not yet completed.
  - .3 Monitor sufficiently often so that causes of delays can immediately be identified and removed.
- .3 Project monitoring and reporting:
  - .1 Keep team aware of changes to schedule, and possible consequences as project progresses.
  - .2 Use narrative reports to provide advice on seriousness of difficulties and measures to overcome them.

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- .3 Begin narrative reporting with statement on general status of Project followed by summarization of delays, potential problems, corrective measures and Project status criticality.
  - .4 Critical Path Method (CPM) Requirements:
    - .1 Ensure Master Plan and Detail Schedule are practical and remain within specified Contract duration.
    - .2 Revise Master Schedule and Detail Schedule deemed impractical by Contract Administrator and resubmit for approval.
    - .3 Change to Contract Duration:
      - .1 Acceptance of Master Schedule and Detail Schedule showing scheduled Contract duration shorter than specified Contract duration does not constitute change to Contract.
      - .2 Duration of Contract may only be changed through bilateral Agreement.
    - .4 Consider Master Schedule and Detail Schedule deemed practical by Contract Administrator, showing Work completed in less than specified Contract duration, to have float.
    - .5 First Milestone on Master Schedule and Detail Schedule will identify start Milestone with an "ES" constraint date equal to Award of Contract date.
    - .6 Calculate dates for completion milestones from Plan and Schedule using specified time periods for Contract.
    - .7 Substantial Completion with "LF" constraint equal to calculated date.
    - .8 Calculations on updates to be such that if early finish of Substantial Completion Certificate falls later than specified Contract duration then float calculation to reflect negative float.
    - .9 Delays to non-critical activities, those with float may not be basis for time extension.
    - .10 Do not use float suppression techniques such as preferential sequencing, imposed dates other than required by Contract, software constraints, extended activity times, and special lead/lag logic restraints.
    - .11 Allow for and show Master Plan and Detail Schedule adverse weather conditions normally anticipated.
      - .1 Specified Contract duration has been predicated assuming normal amount of adverse weather conditions.
    - .12 Provide necessary crews and manpower to meet schedule requirements for performing Work within specified Contract duration.
      - .1 Simultaneous use of multiple crews on multiple fronts on multiple critical paths may be required.
    - .13 Arrange participation on and off site of subcontractors and suppliers, as required by Contract Administrator, for purpose of network planning, scheduling, updating and progress monitoring.
      - .1 Approvals by Contract Administrator of original networks and revisions do not relieve Contractor from duties and responsibilities required by Contract.
    - .14 Ensure that it is understood that Award of Contract or time of beginning, rate of progress, Substantial Completion Certificate and Total Performance Certificate as defined times of completion are of essence of this contract.
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**1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00- Submittal Procedures.
- .2 Submit to Contract Administrator Project Control System for planning, scheduling, monitoring and reporting of project progress.
- .3 Submit Project Control System to Contract Administrator for approval.
- .4 Include costs for execution, preparation and reproduction of schedule submittals in bid documents.
- .5 Submit letter ensuring that schedule has been prepared in co-ordination with major sub-contractors.
- .6 Refer to article "PROGRESS MONITORING AND REPORTING" of this specification Section for frequency of Project control system submittals.
- .7 Submit impact analysis of schedule for changes that result in extension of contract duration.
  - .1 Include draft schedule update and report as outlined in article "PROGRESS MONITORING AND REPORTING".
- .8 Submit Project planning, monitoring and control system data as part of initial schedule submission and monthly status reporting in following form.
  - .1 Master Schedule Bar Chart.
  - .2 Construction Detail schedule Bar Chart.
  - .3 Listing of project activities including milestones and logical connectors, networks (sub-networks) from Project start to end. Sort activities by activity identification number and accompany with descriptions. List early and late start and finish dates together with durations, codes and float.
  - .4 Criticality report listing activities and milestones with zero days total float used as first sort for ready identification of critical paths through entire project. List early and late starts and finishes dates, together with durations, codes and float for critical activities.
  - .5 Progress report in early start sequence, listing for each trade, activities underway, due to start, or finished within 1 months from monthly update date. List activity identification number, description and duration. Provide columns for entry of actual start and finish dates, duration remaining and remarks concerning action required.

**1.6 QUALITY ASSURANCE**

- .1 Use experienced personnel, fully qualified in planning and scheduling to provide services from start of construction to Final Certificate, including Commissioning.

**1.7 WORK BREAKDOWN STRUCTURE (WBS)**

- .1 Prepare construction Work Breakdown Structure (WBS) within two weeks
  - .1 Develop WBS through at least five levels: project, stage, element, sub-element and work package.

**1.8 PROJECT MILESTONES**

- .1 Mandatory and recommended project milestones form targets for both Master Schedule and Detail Schedule of CPM construction network system.
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## 1.9 MASTER SCHEDULE

- .1 Structure and base CPM construction networks system on WBS coding in order to ensure consistency throughout Project.
- .2 Prepare comprehensive construction Master Schedule (CPM logic diagram) and dependent Cash Flow Projection within two weeks.
  - .1 Master Schedule will be used as baseline.
    - .1 Revise baseline as conditions dictate and as required by Contract Administrator.
- .3 Reconcile revisions to Master Schedule and Cash Flow Projections with previous baseline to provide continuous audit trail.
- .4 Initial and subsequent Master Schedule will include:
  - .1 Electronic file containing schedule and cash flow information, clearly labelled with data date, specific update, and person responsible for update.
  - .2 Bar chart identifying coding, activity durations, early/late and start/finish dates, total float, completion as percentile, current status and budget amounts.
  - .3 Network diagram showing coding, activity sequencing (logic), total float, early/late dates, current status and durations.
  - .4 Actual/projected monthly cash flow: expressed monthly and shown in both graphical and numerical form.

## 1.10 DETAIL SCHEDULE

- .1 Provide detailed project schedule (CPM logic diagram) within 7 days of start of Work and bi-weekly updates thereafter until Total Performance.
- .2 Detail CPM schedule to cover in detail minimum period of one month.
  - .1 Show remaining activities for CPM construction network system up to Final Certificate and develop complete detail as project progresses.
  - .2 Detail activities completely and comprehensively throughout duration of project.
- .3 Relate Detail Schedule activities to basic activities and milestones developed and approved in Master Schedule.
- .4 Clearly show sequence and interdependence of construction activities and indicate:
  - .1 Start and completion of all items of Work, their major components, and interim milestone completion dates.
  - .2 Activities for procurement, delivery, installation and completion of each major piece of equipment, materials and other supplies, including:
    - .1 Time for submittals, resubmittals and review.
    - .2 Time for fabrication and delivery of manufactured products for Work.
    - .3 Interdependence of procurement and construction activities.
  - .3 Include sufficient detail to assure adequate planning and execution of Work. Activities should generally range in duration from 3 to 15 workdays each.

- .5 Provide level of detail for project activities such that sequence and interdependency of Contract tasks are demonstrated and allow co-ordination and control of project activities. Show continuous flow from left to right.
- .6 Ensure activities with no float are calculated and clearly indicated on logical CPM construction network system as being, whenever possible, continuous series of activities throughout length of Project to form "Critical Path". Increased number of critical activities is seen as indication of increased risk.
- .7 Insert Change Orders in appropriate and logical location of Detail Schedule. After analysis, clearly state and report to Contract Administrator for review effects created by insertion of new Change Order.

#### **1.11 REVIEW OF THE CONSTRUCTION DETAIL SCHEDULE**

- .1 Allow 5 work days for review by Contract Administrator of proposed construction Detail Schedule.
- .2 Upon receipt of reviewed Detail Schedule make necessary revisions and resubmit to Contract Administrator for review within 5 work days.
- .3 Promptly provide additional information to validate practicability of Detail Schedule as required by Contract Administrator.
- .4 Submittal of Detail Schedule indicates that it meets Contract requirements and will be executed generally in sequence.

#### **1.12 COMPLIANCE WITH DETAIL SCHEDULE**

- .1 Comply with reviewed Detail Schedule.
- .2 Proceed with significant changes and deviations from scheduled sequence of activities that cause delay, only after written receipt of approval by Contract Administrator.
- .3 Identify activities that are behind schedule and causing delay. Provide measures to regain slippage.
  - .1 Corrective measures may include:
    - .1 Increase of personnel on site for effected activities or work package.
    - .2 Increase in equipment.
    - .3 Overtime work and/or Additional work shifts.
- .4 Submit to Contract Administrator justification, project schedule data and supporting evidence for approval of extension to Contract completion date or interim milestone date when required. Include as part of supporting evidence:
  - .1 Written submission of proof of delay based on revised activity logic, duration and costs, showing time impact analysis illustrating influence of each change or delay relative to approved contract schedule.
  - .2 Prepared schedule indicating how change will be incorporated into the overall logic diagram. Demonstrate perceived impact based on date of occurrence of change and include status of construction at that time.
  - .3 Other supporting evidence requested by Contract Administrator.
  - .4 Do not assume approval of Contract extension prior to receipt of written approval from Contract Administrator.

- .5 In event of Contract extension, display in Detail Schedule that scheduled float time available for work involved has been used in full without jeopardizing earned float.
  - .1 Contract Administrator will determine and advise Contractor number of allowable days for extension of Contract based on project schedule updates for period in question, and other factual information.
  - .2 Construction delays affecting project schedule will not constitute justification for extension of contract completion date.

### 1.13 PROGRESS MONITORING AND REPORTING

- .1 On ongoing basis, Detail Schedule on job site must show "Progress to Date". Arrange participation on and off site of subcontractors and suppliers, as, and when necessary, for purpose of network planning, scheduling, updating and progress monitoring. Inspect Work with Contract Administrator at least once monthly to establish progress on each current activity shown on applicable networks.
- .2 Update and reissue project Work Breakdown Structure and relevant coding structures as project develops and changes.
- .3 Perform Detail Schedule update bi-weekly with status dated (Data Date) on last working day of month. Update to reflect activities completed to date, activities in progress, logic and duration changes.
- .4 Do not automatically update actual start and finish dates by using default mechanisms found in project management software.
- .5 Submit to Contract Administrator copies of updated Detail Schedule.
- .6 Requirements for monthly progress monitoring and reporting are basis for progress payment request.
- .7 Submit bi-weekly written report based on Detail Schedule, showing Work to date performed, comparing Work progress to planned, and presenting current forecasts. Report must summarize progress, defining problem areas and anticipated delays with respect to Work schedule, and critical paths. Explain alternatives for possible schedule recovery to mitigate any potential delay. Include in report:
  - .1 Description of progress made.
  - .2 Pending items and status of: permits, possible time extensions, shop drawings, requests for information (RFI), proposed change notices / change orders.
  - .3 Status of Contract completion date and milestones.
  - .4 Current and anticipated problem areas, potential delays and corrective measures.
  - .5 Review of progress and status of Critical Path activities.

## Part 2 Products

### 2.1 NOT USED

- .1 Not used.

**Part 3            Execution**

**3.1                NOT USED**

.1                Not used.

**END OF SECTION**

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**Part 1            General**

**1.1                ADMINISTRATIVE**

- .1        Submit to Contract Administrator submittals listed for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.
- .2        Do not proceed with Work affected by submittal until review is complete.
- .3        Present shop drawings, product data, samples and mock-ups in SI Metric units.
- .4        Where items or information is not produced in SI Metric units converted values are acceptable. Review submittals prior to submission to Contract Administrator. This review represents that necessary requirement have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.
- .5        Notify Contract Administrator, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.
- .6        Verify field measurements and affected adjacent Work are co-ordinated.
- .7        Contractor's responsibility for errors and omissions in submission is not relieved by Contract Administrator's review of submittals.
- .8        Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Contract Administrator review.
- .9        Keep one reviewed copy of each submission on site.

**1.2                SHOP DRAWINGS AND PRODUCT DATA**

- .1        The term "shop drawings" means drawings, diagrams, illustrations, schedules, performance charts, brochures and other data which are to be provided by Contractor to illustrate details of a portion of Work.
  - .2        Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed. Indicate cross references to design drawings and specifications.
  - .3        Allow 14 days for Contract Administrator's review of each submission.
  - .4        Adjustments made on shop drawings by Contract Administrator are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Contract Administrator prior to proceeding with Work.
  - .5        Make changes in shop drawings as Contract Administrator may require, consistent with Contract Documents. When resubmitting, notify Contract Administrator in writing of revisions other than those requested.
  - .6        Accompany submissions with transmittal letter, containing:
    - .1        Date.
    - .2        Project title and number.
    - .3        Contractor's name and address.
-

- .4 Identification and quantity of each shop drawing, product data and sample.
  - .5 Other pertinent data.
  - .7 Submissions include:
    - .1 Date and revision dates.
    - .2 Project title and number.
    - .3 Name and address of:
      - Subcontractor.
      - Supplier.
      - Manufacturer.
    - .4 Contractor's stamp, signed by Contractor's authorized representative certifying approval of submissions, verification of field measurements and compliance with Contract Documents.
    - .5 Details of appropriate portions of Work as applicable:
      - Fabrication.
      - Layout, showing dimensions, including identified field dimensions, and clearances.
      - Setting or erection details.
      - Capacities.
      - Performance characteristics.
      - Standards.
      - Operating weight.
      - Wiring diagrams.
      - Single line and schematic diagrams.
      - Relationship to adjacent Work.
  - .8 After Contract Administrator's review, distribute copies.
  - .9 Submit electronic (PDF format) copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Contract Administrator where shop drawings will not be prepared due to standardized manufacture of product.
  - .10 Submit electronic (PDF format) copies of test reports for requirements requested in specification Sections and as requested by Contract Administrator.
    - .1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.
  - .11 Submit electronic (PDF format) copies of certificates for requirements requested in specification Sections and as requested by Contract Administrator.
    - .1 Statements printed on manufacturer's letterhead and signed by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.
    - .2 Certificates must be dated after award of project contract complete with project name.
  - .12 Submit one electronic PDF copy and 3 hard copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Contract Administrator.
-

- .13 Delete information not applicable to project.
- .14 Supplement standard information to provide details applicable to project.
- .15 If upon review by Contract Administrator, no errors or omissions are discovered or if only minor corrections are made, copies will be returned and fabrication and installation of Work may proceed. If shop drawings are rejected, noted copy will be returned and resubmission of corrected shop drawings, through same procedure indicated above, must be performed before fabrication and installation of Work may proceed.

**1.3 PHOTOGRAPHIC DOCUMENTATION**

- .1 Submit electronic copy of colour digital photography in jpg format, standard resolution monthly with progress statement and as directed by Contract Administrator.
- .2 Project identification: name and number of project and date of exposure indicated.
- .3 Frequency of photographic documentation: weekly.
  - .1 Upon completion of: excavation, foundation, framing and services before concealment, and as directed by Contract Administrator.

**Part 2 Products**

**2.1 NOT USED**

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

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**Part 1            General**

**1.1                SCOPE OF WORK**

- .1    Scope of Work shall include:
  - .1        Preparation and execution of the site-specific Health and Safety Plan.

**1.2                REFERENCE STANDARDS**

- .1    Canada Labour Code, Part 2, Canada Occupational Safety and Health Regulations
- .2    Province of Manitoba
  - .1        The Workers Compensation Act RSM 1987 – c W200.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00- Submittal Procedures.
  - .2    Prepare site-specific Health and Safety Plan using City of Winnipeg template and submit within 7 days after date of Notice to Proceed and prior to commencement of Work. The template is available at the link: <https://www.winnipeg.ca/matmgt/Safety/default.stm>
  - .3    Health and Safety Plan must include:
    - .1        Results of site-specific safety hazard assessment.
    - .2        Results of safety and health risk or hazard analysis for site tasks and operation found in work plan.
    - .3        A hazard analysis specific to the project using the City of Winnipeg Safe Work Plan template shall be submitted by the Contractor prior to starting work.
    - .4        Fall Restraint requirements, certification
    - .5        WHMIS requirements, certification
    - .6        Wastewater hazard control
    - .7        Ventilation requirements
    - .8        Lead abatement
    - .9        Access/egress to the RAS Gallery
    - .10      Exterior/interior laydown area
    - .11      Manual isolation valve and pipe spool lift plans
  - .4    Submit copies of reports or directions issued by Federal, Provincial and Territorial health and safety inspectors.
  - .5    Submit copies of incident and accident reports.
  - .6    Submit WHMIS MSDS - Material Safety Data Sheets
  - .7    Contract Administrator will review Contractor's site-specific Health and Safety Plan and provide comments to Contractor within 10 working days.
  - .8    Contract Administrator's review of Contractor's final Health and Safety plan should not be construed as approval and does not reduce the Contractor's overall responsibility for construction Health and Safety.
-

- .9 Medical Surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of Work, and submit additional certifications for any new site personnel to Contract Administrator.
- .10 On-site Contingency and Emergency Response Plan: address standard operating procedures to be implemented during emergency situations.

#### **1.4 FILING OF NOTICE**

- .1 File Notice of Project with Provincial authorities prior to beginning of Work.
- .2 Contractor shall be responsible and assume the Principal Contractor role for each work zone location and not the entire complex. Contractor shall provide a written acknowledgement of this responsibility with 3 weeks of contract award.
- .3 Work zone locations include:
  - .1 RAS Piping Gallery
- .4 Contractor shall agree to install proper site separation and identification in order to maintain time and space at all times throughout life of project.

#### **1.5 SAFETY ASSESSMENT**

- .1 Perform site specific safety hazard assessment related to project.

#### **1.6 MEETINGS**

- .1 Schedule and administer Health and Safety meeting with Contract Administrator prior to commencement of Work.

#### **1.7 REGULATORY REQUIREMENTS**

- .1 Do Work in accordance with Section 01 41 00- Regulatory Requirements.

#### **1.8 PROJECT/SITE CONDITIONS**

- .1 Work at site will involve contact with:
  - .1 Lead Paint
  - .2 Potential contact with sewage

#### **1.9 GENERAL REQUIREMENTS**

- .1 Develop written site-specific Health and Safety Plan based on hazard assessment prior to beginning site Work and continue to implement, maintain, and enforce plan until final demobilization from site. Health and Safety Plan must address project specifications.
- .2 Contract Administrator may respond in writing, where deficiencies or concerns are noted and may request re-submission with correction of deficiencies or concerns.

#### **1.10 RESPONSIBILITY**

- .1 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.
-

- .2 Comply with and enforce compliance by employees with safety requirements of Contract Documents, applicable federal, provincial, territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

#### **1.11 COMPLIANCE REQUIREMENTS**

- .1 Comply with The Workers Compensation Act, Workplace Safety Regulation, Manitoba Reg. C.C.S.M. c. W210
- .2 Comply with Occupational Health and Safety Regulations, 1996.
- .3 Comply with Canada Labour Code, Canada Occupational Safety and Health Regulations.

#### **1.12 UNFORSEEN HAZARDS**

- .1 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, follow procedures in place for Employee's Right to Refuse Work in accordance with Acts and Regulations of Province having jurisdiction and advise Contract Administrator verbally and in writing.
- .2 When unforeseen or peculiar safety-related factor, hazard, or condition occur during performance of Work, advise Health and Safety co-ordinator and follow procedures in accordance with Acts and Regulations of Province having jurisdiction and advise Contract Administrator verbally and in writing.

#### **1.13 HEALTH AND SAFETY CO-ORDINATOR**

- .1 Employ and assign to Work, competent and authorized representative as Health and Safety Co-ordinator. Health and Safety Co-ordinator must:
  - .1 Have site-related working experience specific to activities associated with municipal water pollution control centres.
  - .2 Have working knowledge of occupational safety and health regulations.
  - .3 Be responsible for completing Contractor's Health and Safety Training Sessions and ensuring that personnel not successfully completing required training are not permitted to enter site to perform Work.
  - .4 Be responsible for implementing, enforcing daily and monitoring site-specific Contractor's Health and Safety Plan.
  - .5 Be on site during execution of Work and report directly to and be under direction of the site supervisor.

#### **1.14 POSTING OF DOCUMENTS**

- .1 Ensure applicable items, articles, notices and orders are posted in conspicuous location on site in accordance with Acts and Regulations of Province having jurisdiction, and in consultation with Contract Administrator.

#### **1.15 CORRECTION OF NON-COMPLIANCE**

- .1 Immediately address health and safety non-compliance issues identified by authority having jurisdiction or by Contract Administrator.
  - .2 Provide Contract Administrator with written report of action taken to correct non-compliance of health and safety issues identified.
  - .3 Contract Administrator may stop Work if non-compliance of health and safety regulations is not corrected.
-

**1.16 POWDER ACTUATED DEVICES**

- .1 Use powder actuated devices only after receipt of written permission from Contract Administrator.

**1.17 HOT WORK PERMITS**

- .1 Hot work permits shall be obtained on daily basis from the Contract Administrator for any hot work taking place during the day.

**1.18 WORK STOPPAGE**

- .1 Give precedence to safety and health of public and site personnel and protection of environment over cost and schedule considerations for Work.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not used.

**END OF SECTION**

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**Part 1            General**

**1.1                SCOPE OF WORK**

- .1            Provisions for temporary utilities as specified herein.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

**1.3                INSTALLATION AND REMOVAL**

- .1            Provide temporary utilities controls in order to execute work expeditiously.
- .2            Remove from site all such work after use.

**1.4                TEMPORARY HEATING AND VENTILATION**

- .1            Provide temporary heating required during construction period, including attendance, maintenance and fuel.
  - .2            Construction heaters used inside building must be vented to outside or be non-flameless type. Solid fuel salamanders are not permitted.
  - .3            Provide temporary heat and ventilation in enclosed areas as required to:
    - .1            Facilitate progress of Work.
    - .2            Protect Work and products against dampness and cold.
    - .3            Prevent moisture condensation on surfaces.
    - .4            Provide ambient temperatures and humidity levels for storage, installation and curing of materials.
    - .5            Provide adequate ventilation to meet health regulations for safe working environment.
  - .4            Maintain temperatures of minimum 15 degrees C in areas where construction is in progress.
  - .5            Ventilating:
    - .1            Prevent accumulations of dust, fumes, mists, vapours or gases in areas occupied during construction.
    - .2            Provide local exhaust ventilation to prevent harmful accumulation of hazardous substances into atmosphere of occupied areas.
    - .3            Dispose of exhaust materials in manner that will not result in harmful exposure to persons.
    - .4            Ventilate storage spaces containing hazardous or volatile materials.
    - .5            Ventilate temporary sanitary facilities.
    - .6            Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful contaminants.
  - .6            Permanent heating system of building, to be used when available. Be responsible for damage to heating system if use is permitted.
  - .7            Maintain strict supervision of operation of temporary heating and ventilating equipment to:
    - .1            Conform with applicable codes and standards.
    - .2            Enforce safe practices.
-

- .3 Prevent abuse of services.
- .4 Prevent damage to finishes.
- .5 Vent direct-fired combustion units to outside.
- .8 Be responsible for damage to Work due to failure in providing adequate heat and protection during construction.

**1.5 TEMPORARY POWER AND LIGHT**

- .1 The Contractor shall have access to convenience receptacles where available for construction power.
- .2 Where additional construction power is required, space for a 600VAC feed, not to exceed 50 kVA from MCC-2A in the Secondary Clarifier Electrical Room will be made available. The Contractor shall be responsible for supplying and installing all breakers, cables, transformers, and panels necessary to bring temporary construction power to the desired location.
- .3 The Contractor shall provide temporary lighting in areas where existing lighting is obstructed by scaffolding and other construction equipment. Existing lighting levels shall be maintained to permit continuation of City operations activities.
- .4 The Contractor shall be responsible for providing temporary lighting for construction.

**1.6 TEMPORARY COMMUNICATION FACILITIES**

- .1 Provide and pay for temporary fax, telephone, data hook up, line equipment necessary for own use.

**1.7 FIRE PROTECTION**

- .1 Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.
- .2 Burning rubbish and construction waste materials is not permitted on site.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

**END OF SECTION**

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**Part 1            General**

**1.1                SCOPE OF WORK**

- .1            Provide construction facilities as detained herein.

**1.2                REFERENCE STANDARDS**

- .1            Canadian General Standards Board (CGSB)
  - .1            CAN/CGSB 1.189-[00], Exterior Alkyd Primer for Wood.
  - .2            CGSB 1.59-[97], Alkyd Exterior Gloss Enamel.
- .2            Canadian Standards Association (CSA International)
  - .1            CSA-A23.1/A23.2-[04], Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2            CSA-0121-[M1978(R2003)], Douglas Fir Plywood.
  - .3            CAN/CSA-S269.2-[M1987(R2003)], Access Scaffolding for Construction Purposes.
  - .4            CAN/CSA-Z321-[96(R2001)], Signs and Symbols for the Occupational Environment.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1            Provide submittals in accordance with Section 01 33 00- Submittal Procedures.

**1.4                INSTALLATION AND REMOVAL**

- .1            Prepare site plan indicating proposed location and dimensions of area to be fenced and used by Contractor, number of trailers to be used, avenues of ingress/egress to fenced area and details of fence installation.
- .2            Identify areas which have to be gravelled to prevent tracking of mud.
- .3            Indicate use of supplemental or other staging area.
- .4            Provide construction facilities in order to execute work expeditiously.
- .5            Remove from site all such work after use.

**1.5                SCAFFOLDING**

- .1            Scaffolding in accordance with CAN/CSA-S269.2.
- .2            Provide and maintain scaffolding, ramps, platforms, ladders, and temporary stairs.

**1.6                HOISTING**

- .1            Provide, operate and maintain hoists required for moving of workers, materials and equipment. Make financial arrangements with Subcontractors for their use of hoists.
- .2            Hoists to be operated by qualified operator.

**1.7                SITE STORAGE/LOADING**

- .1            Confine work and operations of employees by Contract Documents. Do not unreasonably encumber premises with products.
-

- .2 Do not load or permit to load any part of Work with weight or force that will endanger Work.

#### **1.8 CONSTRUCTION PARKING**

- .1 Parking will be permitted on site provided it does not disrupt performance of the City's normal operations.
- .2 Provide and maintain adequate access to project site.

#### **1.9 SECURITY**

- .1 Construction site security, including laydown areas, is the responsibility of the contractor.
- .2 The Contractor must receive approval from the City prior to hiring 24-hour security staff for their laydown area.

#### **1.10 OFFICES**

- .1 Provide office heated to 22 degrees C, lighted 750 lx and ventilated, of sufficient size to accommodate site meetings and furnished with drawing laydown table.
- .2 Provide marked and fully stocked first-aid case in a readily available location.
- .3 Subcontractors to provide their own offices as necessary. Direct location of these offices.
- .4 Provide a space within the office for Contract Administrator use complete with a desk and chair.

#### **1.11 EQUIPMENT, TOOL AND MATERIALS STORAGE**

- .1 Provide and maintain, in clean and orderly condition, lockable weatherproof sheds for storage of tools, equipment and materials.
- .2 Locate materials not required to be stored in weatherproof sheds on site in manner to cause least interference with work activities.

#### **1.12 SANITARY FACILITIES**

- .1 Provide sanitary facilities for work force in accordance with governing regulations and ordinances. Locate in area(s) designated by Contract Administrator.
- .2 Post notices and take precautions as required by local health authorities. Keep area and premises in sanitary condition.
- .3 Contractor will **not** be allowed to use the existing sanitary facilities in the building.

#### **1.13 CONSTRUCTION SIGNAGE**

- .1 No other signs or advertisements, other than warning signs, are permitted on site.
- .2 Graphic symbols to CAN/CSA-Z321.
- .3 Maintain approved signs and notices in good condition for duration of project, and dispose of off site on completion of project or earlier if directed by Contract Administrator.

#### **1.14 PROTECTION AND MAINTENANCE OF TRAFFIC**

- .1 Contractor's traffic on roads selected for hauling material to and from site to interfere as little as possible with public traffic.
  - .2 Verify adequacy of existing roads and allowable load limit on these roads. Contractor: responsible for repair of damage to roads caused by construction operations.
-

- .3 Provide necessary lighting, signs, barricades, and distinctive markings for safe movement of traffic.

**1.15 CLEAN-UP**

- .1 Work areas shall be cleaned **daily**. Incorporate effective dust control measures to keep the piping and pipe wrap in clean condition.
- .2 Remove construction debris, waste materials, packaging material from work site **daily**.
- .3 Clean dirt or mud tracked into facility immediately.
- .4 Store materials resulting from demolition activities that are salvageable in designated areas.
- .5 Stack stored new or salvaged material not in construction facilities.
- .6 Snow clearing of the construction site and site access as and when required is the responsibility of the contractor.

**1.16 SITE LAYDOWN AREA**

- .1 See Appendix G for details of the Contractor laydown area and access to the Secondary Clarifier Building and the RAS Gallery.

**1.17 GANTRY CRANE & ACCESS HATCH**

- .1 Access to the maintenance shop located in the Secondary Clarifier Building shall only be provided during typical working hours for plant personnel (i.e. 08:00 to 16:00).
- .2 A minimum of 5 business days notice is required prior to use of the gantry crane and blower room access hatch located in the maintenance shop to reduce disruption of plant maintenance work.
- .3 Operation of the gantry crane shall be by the Contractor under direction and supervision of City staff. Responsibility for operation of the crane remains with the Contractor.
  - .1 The Contractor shall develop a simple lift plan prior to use and retain this plan for presentation upon request by the Contract Administrator. This plan shall include the proposed load and rigging arrangement, and results of a detailed inspection of the crane and rigging.
  - .2 The Contractor shall be responsible for damage to the crane, hatch or surrounding equipment resulting from use of the crane.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                ADMINISTRATIVE REQUIREMENTS**

- .1    Pre-warranty Meeting:
  - .1    Convene meeting one week prior to contract completion with Contract Administrator to:
    - .1    Verify Project requirements.
    - .2    Review warranty requirements.
  - .2    Contract Administrator shall establish communication procedures for:
    - .1    Notifying construction warranty defects.
    - .2    Determine priorities for type of defects.
    - .3    Determine reasonable response time.
  - .3    Contact information for bonded and licensed company for warranty work action: provide name, telephone number and address of company authorized for construction warranty work action.
  - .4    Ensure contact is located within local service area of warranted construction, is continuously available, and is responsive to inquiries for warranty work action.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Provide submittals in accordance with Section 01 33 00- Submittal Procedures.
- .2    Two weeks prior to Substantial Performance of the Work, submit to the Contract Administrator, three final copies (hard copies and electronic PDF) of operating and maintenance manuals.
- .3    Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
- .4    Provide evidence, if requested, for type, source and quality of products supplied.

**1.3                FORMAT**

- .1    Organize data as instructional manual.
  - .2    Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
  - .3    When multiple binders are used correlate data into related consistent groupings.
    - .1    Identify contents of each binder on spine.
  - .4    Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.
  - .5    Arrange content by systems under Section numbers and sequence of Table of Contents.
  - .6    Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.
  - .7    Text: manufacturer's printed data, or typewritten data.
  - .8    Drawings: provide with reinforced punched binder tab.
    - .1    Bind in with text; fold larger drawings to size of text pages.
  - .9    Provide electronic PDF files in USB drives.
-

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#### **1.4 CONTENTS - PROJECT RECORD DOCUMENTS**

- .1 Table of Contents for Each Volume: provide title of project;
  - .1 Date of submission; names.
  - .2 Addresses, and telephone numbers of Contractor with name of responsible parties.
  - .3 Schedule of products and systems, indexed to content of volume.
- .2 For each product or system:
  - .1 List names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- .3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.
- .4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.
- .5 Typewritten Text: as required to supplement product data.
  - .1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified in Section 01 45 00- Quality Control.
- .6 Training: refer to Section 01 79 00- Demonstration and Training.

#### **1.5 AS -BUILT DOCUMENTS AND SAMPLES**

- .1 Maintain at site for Contract Administrator one record copy of:
  - .1 Contract Drawings.
  - .2 Specifications.
  - .3 Addenda.
  - .4 Change Orders and other modifications to Contract.
  - .5 Reviewed shop drawings, product data, and samples.
  - .6 Field test records.
  - .7 Inspection certificates.
  - .8 Manufacturer's certificates.
- .2 Store record documents and samples in field office apart from documents used for construction.
  - .1 Provide files, racks, and secure storage.
- .3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
  - .1 Label each document "PROJECT RECORD" in neat, large, printed letters.
- .4 Maintain record documents in clean, dry and legible condition.
  - .1 Do not use record documents for construction purposes.
- .5 Keep record documents and samples available for inspection by Contract Administrator.

#### **1.6 RECORDING INFORMATION ON PROJECT RECORD DOCUMENTS**

- .1 Record information on set of drawings, and in copy of Project Manual, provided by Contract Administrator.
-

- .2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.
- .3 Record information concurrently with construction progress.
  - .1 Do not conceal Work until required information is recorded.
- .4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
  - .1 Measured depths of elements of foundation in relation to finish first floor datum.
  - .2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
  - .3 Measured locations of internal utilities and appurtenances, referenced to visible and accessible features of construction.
  - .4 Field changes of dimension and detail.
  - .5 Changes made by change orders.
  - .6 Details not on original Contract Drawings.
  - .7 Referenced Standards to related shop drawings and modifications.
- .5 Specifications: mark each item to record actual construction, including:
  - .1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.
  - .2 Changes made by Addenda and change orders.
- .6 Other Documents: maintain manufacturer's certifications, inspection certifications, field test records, required by individual specifications sections.
- .7 Provide digital photos, if requested, for site records.

## **1.7 EQUIPMENT AND SYSTEMS**

- .1 For each item of equipment and each system include description of unit or system, and component parts.
    - .1 Give function, normal operation characteristics and limiting conditions.
    - .2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.
  - .2 Panel board circuit directories: provide electrical service characteristics, controls, and communications.
  - .3 Include installed colour coded wiring diagrams.
  - .4 Operating Procedures: include start-up, break-in, and routine normal operating instructions and sequences.
    - .1 Include regulation, control, stopping, shut-down, and emergency instructions.
    - .2 Include summer, winter, and any special operating instructions.
  - .5 Maintenance Requirements: include routine procedures and guide for trouble-shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
  - .6 Provide servicing and lubrication schedule, and list of lubricants required.
  - .7 Include manufacturer's printed operation and maintenance instructions.
  - .8 Include sequence of operation by controls manufacturer.
-

- .9 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- .10 Provide installed control diagrams by controls manufacturer.
- .11 Provide Contractor's co-ordination drawings, with installed colour coded piping diagrams.
- .12 Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- .13 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- .14 Additional requirements: as specified in individual specification sections.

## **1.8 MAINTENANCE MATERIALS**

- .1 Spare Parts:
  - .1 Provide spare parts, in quantities specified in individual specification sections.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Contract Administrator.
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit prior to final payment.
- .2 Extra Stock Materials:
  - .1 Provide maintenance and extra materials, in quantities specified in individual specification sections.
  - .2 Provide items of same manufacture and quality as items in Work.
  - .3 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Contract Administrator.
    - .2 Include approved listings in Maintenance Manual.
  - .5 Obtain receipt for delivered products and submit prior to final payment.
- .3 Special Tools:
  - .1 Provide special tools, in quantities specified in individual specification section.
  - .2 Provide items with tags identifying their associated function and equipment.
  - .3 Deliver to location as directed; place and store.
  - .4 Receive and catalogue items.
    - .1 Submit inventory listing to Contract Administrator.
    - .2 Include approved listings in Maintenance Manual.

## **1.9 DELIVERY, STORAGE AND HANDLING**

- .1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.
  - .2 Store in original and undamaged condition with manufacturer's seal and labels intact.
  - .3 Store components subject to damage from weather in weatherproof enclosures.
-

- .4 Store paints and freezable materials in a heated and ventilated room.
- .5 Remove and replace damaged products at own expense and for review by Contract Administrator.

**1.10 WARRANTIES AND BONDS**

- .1 Develop warranty management plan to contain information relevant to Warranties.
- .2 Submit warranty management plan, 30 days before planned pre-warranty conference, to Contract Administrator approval.
- .3 Warranty management plan to include required actions and documents to assure that Contract Administrator receives warranties to which it is entitled.
- .4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.
- .5 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:
  - .1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.
  - .2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.
  - .3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within [ten]days after completion of applicable item of work.
  - .4 Verify that documents are in proper form, contain full information, and are notarized.
  - .5 Co-execute submittals when required.
  - .6 Retain warranties and bonds until time specified for submittal.
- .6 Except for items put into use with City's permission, leave date of beginning of time of warranty until Date of Total Performance is determined.
- .7 Conduct joint warranty inspection, measured from time of acceptance, by Contract Administrator.
- .8 Include information contained in warranty management plan as follows:
  - .1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.
  - .2 Provide list for each warranted equipment, item, feature of construction or system indicating:
    - .1 Name of item.
    - .2 Model and serial numbers.
    - .3 Location where installed.
    - .4 Name and phone numbers of manufacturers or suppliers.
    - .5 Names, addresses and telephone numbers of sources of spare parts.
    - .6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.
    - .7 Cross-reference to warranty certificates as applicable.
    - .8 Starting point and duration of warranty period.

- .9 Summary of maintenance procedures required to continue warranty in force.
- .10 Cross-Reference to specific pertinent Operation and Maintenance manuals.
- .11 Organization, names and phone numbers of persons to call for warranty service.
- .12 Typical response time and repair time expected for various warranted equipment.
- .3 Contractor's plans for attendance at post-construction warranty inspections.
- .4 Procedure and status of tagging of equipment covered by extended warranties.
- .5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/or safety reasons.
- .9 Respond in timely manner to oral or written notification of required construction warranty repair work.
- .10 Written verification to follow oral instructions.
  - .1 Failure to respond will be cause for the Contract Administrator to proceed with action against Contractor.

**1.11 WARRANTY TAGS**

- .1 Tag, at time of installation, each warranted item. Provide durable, oil and water-resistant tag approved by Contract Administrator.
- .2 Attach tags with copper wire and spray with waterproof silicone coating.
- .3 Leave date of acceptance until project is accepted for occupancy.
- .4 Indicate following information on tag:
  - .1 Type of product/material.
  - .2 Model number.
  - .3 Serial number.
  - .4 Contract number.
  - .5 Warranty period.
  - .6 Inspector's signature.
  - .7 Construction Contractor.

**Part 2 Products**

**2.1 NOT USED**

- .1 Not Used.

**Part 3 Execution**

**3.1 NOT USED**

- .1 Not Used.

**END OF SECTION**

**Part 1            General**

**1.1                SUMMARY**

- .1 Comply with requirements of this Section when performing following Work:
  - .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap on pipe surface as required for installation of CFRP composite pipe wrap repair.
  - .2 Removal of lead-containing coatings or materials using a power tool with an effective dust collection system equipped with a HEPA filter on pipe surface as required for installation of CFRP composite pipe wrap repair.
  - .3 Removal of lead-containing coatings or materials with non-powered hand tool, other than manual scraping and sanding on pipe surface as required for installation of CFRP composite pipe wrap repair.

**1.2                RELATED REQUIREMENTS**

- .1 Section 23 21 10 - Carbon Fibre Reinforced Plastic Composite Repair System

**1.3                DEFINITIONS**

- .1 HEPA vacuum: High Efficiency Particulate Air filtered vacuum equipment with a filter system capable of collecting and retaining fibres greater than 0.3 microns in any direction at 99.97% efficiency.
  - .2 Authorized Visitors: City WWD, NEWPCC Operations, Contract Administrator or designated representatives.
  - .3 Polyethylene: polyethylene sheeting or rip-proof polyethylene sheeting with tape along edges, around penetrating objects over cuts and tears, and elsewhere as required to provide protection and isolation. For protection of underlying surfaces from damage and to prevent lead dust entering in clean area.
  - .4 Sprayer: garden reservoir type sprayer or airless spray equipment capable of producing mist or fine spray. Must be appropriate capacity for scope of work.
  - .5 Action level: employee exposure, without regard to use of respirators, to airborne concentration of lead of 50 micrograms per cubic metre of air ( $50 \text{ ug/m}^3$ ) calculated as 8-hour time-weighted average (TWA). Minimum precautions for lead abatement are based on airborne lead concentrations less than 0.05 milligrams per cubic metre of air for removal of lead-based paint by methods noted in paragraph 1.1.
  - .6 Competent person: Individuals capable of identifying existing lead hazards in the workplace and capable of taking corrective measures to eliminate them.
  - .7 Lead dust: wipe sampling on vertical surfaces and/or horizontal surfaces, dust and debris is considered to be lead contaminated if it contains more than 40 micrograms of lead in dust per square foot.
  - .8 Application Specialist: An individual who performs surface preparation and application of protective coatings and linings to steel and concrete surfaces of complex industrial structures.
-

#### **1.4 REFERENCE STANDARDS**

- .1 Department of Justice Canada
  - .1 Canadian Environmental Protection Act, 1999 (CEPA).
- .2 Health Canada
  - .1 Workplace Hazardous Materials Information System (WHMIS).
    - .1 Safety Data Sheets (SDS).
- .3 Human Resources and Social Development Canada (HRSDC)
  - .1 Canada Labour Code Part II, - SOR 86-304 - Occupational Health and Safety Regulations.
- .4 Transport Canada (TC)
  - .1 Transportation of Dangerous Goods Act, 1992 (TDGA).
- .5 United States Environmental Protection Agency (EPA)
  - .1 EPA 747-R-95-007- [1995], Sampling House Dust for Lead.
- .6 U.S. Department of Health and Human Services/Centers for Disease Control and Prevention/National Institute for Occupational Safety and Health (NIOSH)
  - .1 NIOSH 94-113 - NIOSH Manual of Analytical Methods (NMAM), 4th Edition (1994).
- .7 U.S. Department of Labour - Occupational Safety and Health Administration (OSHA) - Toxic and Hazardous Substances
  - .1 Lead in Construction Regulation - 29 CFR 1926.62- 1993.
- .8 Province of Manitoba
  - .1 The Workplace Safety and Health Act - Updated 2017.
- .9 NACE International
  - .1 NACE International
    - .1 ANSI/NACE No. 13/SSPC-ACS-1- 2016 -SG, Industrial Coating and Lining Application Specialist Qualification and Certification.

#### **1.5 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Provide proof satisfactory to the Contract Administrator that suitable arrangements have been made to dispose of lead-based paint waste in accordance with requirements of authority having jurisdiction.
  - .3 Provide proof of Contractor's General and Environmental Liability Insurance.
  - .4 Quality Control:
    - .1 Provide the Contract Administrator necessary permits for transportation and disposal of lead-based paint waste and proof that lead based paint waste has been received and properly disposed of.
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- .2 Provide proof satisfactory to the Contract Administrator that employees have had instruction on hazards of lead exposure, respirator use, dress, and aspects of work procedures and protective measures.
- .5 Certificates:
  - .1 Submit certifications for Application Specialists to demonstrate compliance to the requirements of ANSI/NACE No.13.

## 1.6 QUALITY ASSURANCE

- .1 Regulatory Requirements: Comply with Federal, Provincial, Territorial and local requirements pertaining to lead paint, provided that in case of conflict among those requirements or with these specifications more stringent requirement applies. Comply with regulations in effect at time work is performed.
- .2 Qualifications:
  - .1 Ensure that 50% of persons, who perform concrete and steel surfaces preparation and coating applications, are certified by a recognized Applicator Certification Agency, in accordance with NACE 13 /SSPC ACS-I , Applicator Certification Standard (ACS).
  - .2 Maintain a current and valid ACS certification during project period.
    - .1 Application specialists who perform surface preparation and coating application work on this project must have a current ACS.
  - .3 Notify the Contract Administrator of any change in application specialist certification status.
    - .1 Any delays to the completion of the Project due to invalid certifications will not be considered, and liquidated damages shall not be waived for any non-performance by Contractor.
- .3 Health and Safety:
  - .1 Do construction occupational health and safety in accordance with Section 01 35 29.06 - Health and Safety Requirements.
  - .2 Safety Requirements: worker and visitor protection.
    - .1 Protective equipment and clothing to be worn by workers and visitors in work Area include:
      - .1 Respirator NIOSH approved and equipped with replaceable HEPA filter cartridges with an assigned protection factor of 10, acceptable to Authority having jurisdiction. Suitable for type of lead and level of lead dust exposure. Provide sufficient amount of filters.
    - .2 Eating, drinking, chewing, and smoking are not permitted in work area.
    - .3 Ensure workers wash hands and face when leaving work area. Facilities for washing are to be arranged by the Contractor.
    - .4 Visitor Protection:
      - .1 Provide approved respirators to Authorized Visitors to work areas.
      - .2 Instruct Authorized Visitors on procedures to be followed in entering and exiting work area.

## **1.7 WASTE MANAGEMENT AND DISPOSAL**

- .1 Separate waste materials for reuse and recycling.
- .2 Handle and dispose of hazardous materials in accordance with CEPA , TDGA , Regional and Municipal regulations.
- .3 Disposal of lead waste generated by removal activities must comply with Federal, Provincial, Territorial and Municipal regulations. Dispose of lead waste in sealed double thickness 0.15 mm bags or leak proof drums. Label containers with appropriate warning labels.
- .4 Provide manifests describing and listing waste created. Transport containers by approved means to licensed landfill for burial.

## **1.8 EXISTING CONDITIONS**

- .1 Reports and information pertaining to lead based paint to be handled, removed, or otherwise disturbed and disposed of during this Project are located in Appendix F.
- .2 Notify the Contract Administrator of lead-based paint discovered during Work and not apparent from drawings, specifications, or report pertaining to Work. Do not disturb such material until instructed by the Contract Administrator.

## **1.9 SCHEDULING**

- .1 Not later than two days before beginning Work on this Project notify following in writing:
  - .1 Appropriate NEWPCC Plant OSH Officer.
  - .2 Appropriate NEWPCC Plant Environmental Officer.
  - .3 Disposal Authority.
- .2 Inform sub trades of presence of lead-containing materials identified in Existing Conditions.
- .3 Provide the Contract Administrator copy of notifications prior to start of Work.
- .4 Hours of Work: perform work involving lead abatement located in the RAS Piping Gallery outside of normal working hours if required by Plant Operations.

## **1.10 PERSONNEL TRAINING**

- .1 Provide the Contract Administrator satisfactory proof that every worker has had instruction and training in hazards of lead exposure, in personal hygiene, in aspects of work procedures, and in use, cleaning, and disposal of respirators if required.
  - .2 Instruction and training related to respirators includes, at minimum:
    - .1 Proper fitting of equipment.
    - .2 Inspection and maintenance of equipment.
    - .3 Disinfecting of equipment.
    - .4 Limitations of equipment.
  - .3 Instruction and training must be provided by competent, qualified person.
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- .4 Supervisory personnel to complete required training.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Polyethylene 0.15 mm thick unless otherwise specified; in sheet size to minimize joints.
- .2 Tape: fibreglass - reinforced duct tape suitable for sealing polyethylene under dry conditions and wet conditions using amended water.
- .3 Slow - drying sealer: non-staining, clear, water - dispersible type that remains tacky on surface for at least 8 hours and designed for purpose of trapping residual lead paint residue.
- .4 Lead waste containers: Metal or fibre type acceptable to dump operator with tightly fitting covers and 0.15 mm thickness sealable polyethylene liners.
  - .1 Label containers with pre-printed bilingual cautionary Warning Lead clearly visible when ready for removal to disposal site.

## **Part 3 Execution**

### **3.1 SUPERVISION**

- .1 One Supervisor for every ten workers is required.
- .2 Supervisor must remain within work area during disturbance, removal, or handling of lead-based paints.

### **3.2 PREPARATION**

- .1 Remove and store items to be salvaged or reused.
    - .1 Protect and wrap items and transport and store in area specified by the Contract Administrator.
  - .2 Work Area:
    - .1 Provide signage to clearly indicate areas where lead-abatement work is being done to Plant staff working in the area.
    - .2 Shut off and isolate HVAC system to prevent dust dispersal into other building areas. Conduct smoke tests to ensure duct work is airtight.
    - .3 Pre-clean fixed casework and equipment within work area, using HEPA vacuum and cover and seal with polyethylene sheeting and tape.
    - .4 Clean work area using HEPA vacuum. If not practicable, use wet cleaning method. Do not raise dust.
    - .5 Seal off openings with polyethylene sheeting and seal with tape.
    - .6 Protect floor surfaces covered from wall to wall with polyethylene sheets.
    - .7 Maintain emergency fire exits or establish alternatives satisfactory to Authority having jurisdiction.
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- .8 Where water application is required for wetting lead containing materials, provide temporary water supply appropriately sized for application of water as required.
- .9 Provide electrical power and shut off [for operation of powered tools and equipment. Provide 24-volt safety lighting and ground fault interrupter circuits on power source for electrical tools, in accordance with applicable CSA Standard. Ensure safe installation of electrical cables and equipment
- .3 Do not start work until:
  - .1 Arrangements have been made for disposal of waste.
  - .2 Tools, equipment, and materials waste containers are on site.
  - .3 Arrangements have been made for building security.
  - .4 Notifications have been completed and preparatory steps have been taken.

### **3.3 LEAD ABATEMENT**

- .1 Removal of lead-containing coatings with a chemical gel or paste and fibrous laminated cloth wrap; or removal equipped with HEPA filters; or removal with using power tools non-powered hand tool, other than manual scraping and sanding.
- .2 Remove lead-based paint in small sections and pack as it is being removed in sealable 0.15 mm plastic bags and place in labelled containers for transport.
- .3 Seal filled containers. Clean external surfaces thoroughly by wet sponging. Remove from immediate working area to staging area. Clean external surfaces thoroughly again by wet sponging. Wash containers thoroughly pending removal to outside. Ensure containers are removed by workers who have entered from uncontaminated areas dressed in clean coveralls.
- .4 After completion of stripping work, wire brush and wet sponge surface from which lead based paint has been removed to remove visible material. During this work keep surfaces wet.
- .5 After wire brushing and wet sponging to remove visible lead-based paint, and after encapsulating lead containing material impossible to remove, wet clean entire work area, and equipment used in process. After inspection, apply continuous coat of slow drying sealer to surfaces of work area, if required. Do not disturb work area for 8 hours. No entry, activity, ventilation, or disturbance during this period.

### **3.4 INSPECTION**

- .1 Perform inspection to confirm compliance with specification and governing authority requirements. Deviations from these requirements not approved in writing by the Contract Administrator will result in work stoppage, at no cost to The City.

### **3.5 LEAD SURFACE SAMPLING - WORK AREAS**

- .1 Final lead surface sampling to be conducted as follows:
  - .1 After work area has passed a visual inspection for cleanliness, apply coat of lock-down agent to surfaces within enclosure, and appropriate setting period of 8 hours has passed, if required.

**3.6 FINAL CLEANUP**

- .1 Following cleaning and when lead wipe surfaces sampling are below acceptable concentrations, proceed with final cleanup.
- .2 Remove polyethylene sheet by rolling it away from walls to centre of work area. Vacuum visible lead containing particles observed during cleanup, immediately, using HEPA vacuum.
- .3 Place polyethylene sheets, tape, cleaning material, clothing, and contaminated waste in plastic bags and sealed labelled waste containers for transport.
- .4 Conduct final check to ensure no dust or debris remains on surfaces as result of dismantling operations.

**3.7 RE-ESTABLISHMENT OF OBJECTS AND SYSTEMS**

- .1 Repair or replace objects damaged in course of work to their original state or better, as directed by the Contract Administrator.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1    CSA-A23.1-09/A23.2-09 - Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
- .2    CSA-A3000-13 - Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
- .3    ASTM C881/C881M-13 - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
- .4    ASTM C1059/C1059M-99(2008) - Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete.
- .5    CAN/CSA S269.1, Falsework for Construction Purposes.
- .6    CAN/CSA S269.3, Concrete Formwork.
- .7    ICRI Guideline No. 310.1R-2008 (formerly No. 03730), "Guide for Surface Preparation for the Repair of Deteriorated Concrete Resulting from Reinforcing Steel Corrosion, International Concrete Repair Institute, 2008.

**1.2                SUBMITTALS FOR REVIEW**

- .1    Section 01 33 00: Submission procedures.
- .2    Product Data: Indicate product standards, physical and chemical characteristics, technical specifications, limitations, maintenance instructions, and general recommendations regarding each material.

**1.3                QUALITY ASSURANCE**

- .1    Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three (3) years documented experience.
- .2    Applicator Qualifications: Company specializing in performing the work of this section with minimum three (3) years documented experience.
- .3    Design reinforcement splices under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed at the place where the Project is located.

**1.4                DELIVERY, STORAGE, AND PROTECTION**

- .1    Section 01 61 00: Transport, handle, store, and protect products.
- .2    Comply with instructions for storage, shelf-life limitations, and handling.

**Part 2            Products**

**2.1                EQUIPMENT**

- .1    For removal of concrete with pneumatic hammers at and beyond the first level of reinforcing steel, use maximum 7 kg (15 lb) hammers.
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## **2.2 PATCHING MATERIALS**

- .1 Site Mixed Concrete: MasterEmaco T 1060 (with aggregate extension) and MasterEmaco T 240 by BASF or approved equal in accordance with B8. Aggregate for extending the mortar shall be certified for use in concrete and approved by the Contract Administrator.
- .2 Bonding Agents: Cementitious slurry in accordance with the repair mortar product manufacturer's instructions. Minimum bond strength 1.0 MPa.
- .3 Water: Clean and potable.

## **Part 3 Execution**

### **3.1 EXAMINATION AND IDENTIFICATION OF REPAIR AREAS**

- .1 Determine the extent of delaminated concrete by hammer tap and/or chain drag. Repair areas shall also include spalled concrete. Mark all areas with spray paint and allow for verification by the Contract Administrator.
- .2 Include in the repair those areas of sound concrete adjacent to delaminated concrete as directed by the Contract Administrator.

### **3.2 PREPARATION**

- .1 Removal of concrete:
    - .1 For patching of floor areas, remove loose concrete. Provide 12mm saw cut around perimeter of damaged area and chip down to minimum repair mortar thickness as per product manufacturer instructions.
    - .2 For all other structural repairs:
      - .1 Remove concrete from the repair areas and continue removal to 20 mm around both layers of bars in the top or bottom mat of reinforcing. Should unsound concrete continue beyond this point continue removal until all defective concrete is removed. Avoid damage to embedded services.
      - .2 Do not damage reinforcing steel that is to remain and avoid damage to sound concrete. Do not remove reinforcing steel without the approval of the Contract Administrator.
      - .3 Remove obsolete chairs, ties and services.
      - .4 Should unsound concrete continue beyond the limits marked, obtain the Contract Administrator's approval prior to proceeding with the removal in these areas.
      - .5 Provide a 12 mm saw-cut vertical edge at the perimeter of the repair areas. Do not cut reinforcing steel.
      - .6 Do not stockpile concrete rubble on suspended slabs. Remove rubble from the work area on a daily basis.
  - .2 Surface preparation:
    - .1 Prepare the surface in accordance with ICRI Guideline No. 310.1R-2008 and as specified herein. This includes removal of concrete around all corroded reinforcing steel unless otherwise directed by the Contract Administrator.
    - .2 Sound all areas to ensure all defective concrete has been removed. Obtain Contract Administrator's approval and remove any defective concrete as identified above.
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- .3 Obtain Contract Administrator's approval before proceeding with surface preparation.
- .4 Abrasive blast cleans the concrete surface, exposed reinforcing steel and embedded hardware within the repair areas to remove all materials that may impair the bond of the new concrete including defective concrete, rust, dirt, scale, etc. to the satisfaction of the Contract Administrator. Wire brushing is not permitted.
- .5 Allow for inspection by the Contract Administrator. If required, provide additional abrasive blast cleaning as directed by the Contract Administrator.

### **3.3 REPAIR WORK**

- .1 Repair exposed structural, shrinkage, and settlement cracks of concrete by the bonding agent and concrete method.
- .2 Repair spalling. Fill voids flush with surface.

### **3.4 CONCRETE PLACEMENT**

- .1 Maintain concrete substrate continuously moist for 24 hours prior to placement of concrete.
- .2 Immediately prior to placing concrete remove ponding water and scrub bonding agent into concrete surfaces.
- .3 Place concrete while bonding agent is still damp.
- .4 Consolidate concrete thoroughly around all reinforcing and embedded hardware using vibrators and other means as necessary.

### **3.5 FINISHING AND CURING**

- .1 Finish surfaces to the lines and levels of adjacent concrete.
- .2 Provide a suitable finish for surfaces to be coated with protective membrane or sealer.
- .3 Cure concrete with wet burlap or other suitable means and keep continuously moist 7 days or as required by the manufacturer for polymer modified mortar. Commence curing immediately after finishing. DO NOT use curing agents on surfaces to receive a protective membrane or sealer.
- .4 Reinstate surface mounted conduit, light fixtures, signs, drain pipes and other items removed to facilitate the work.

### **3.6 FIELD QUALITY CONTROL**

- .1 Concrete and Mortar
  - .1 Arrange for testing of concrete/mortar by an independent testing firm.
  - .2 Testing shall be for each day of concrete/mortar placement unless otherwise directed by the Contract Administrator.
  - .3 Test cylinders or cubes (as appropriate) shall be cast for evaluating the compressive strength of the concrete/mortar. Tests for 7-Day and 28-Day strengths will be required as a minimum.

**END OF SECTION**

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**PART 1            General**

**1.1                RELATED REQUIREMENTS**

- .1        03 20 00        Concrete Reinforcing
- .2        03 30 00        Cast-In-Place Concrete

**1.2                REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA-A23.1-14/A23.2-14, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
  - .2        CSA-O86-14, Engineering Design in Wood.
  - .3        CSA O121-08(R2013), Douglas Fir Plywood.
  - .4        CSA O151-17, Canadian Softwood Plywood.
  - .5        CSA O153-13, Poplar Plywood.
  - .6        CAN/CSA-O325-16, Construction Sheathing.
  - .7        CSA O437 Series-93(R2011), Standards for OSB and Waferboard.
  - .8        CSA S269.1-16, Falsework and Formwork.
- .2        Underwriters' Laboratories of Canada (ULC)
  - .1        CAN/ULC-S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

**1.3                ACTION AND INFORMATIONAL SUBMITTALS**

- .1        Submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2        Submit shop drawings for formwork and falsework.
  - .1        Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
- .3        Indicate method and schedule of construction, shoring, stripping and re-shoring procedures, materials, arrangement of joints, special architectural exposed finishes, ties, liners, and locations of temporary embedded parts. Comply with CSA S269.1 for formwork and falsework drawings.
- .4        Indicate formwork design data: permissible rate of concrete placement, and temperature of concrete, in forms.

**PART 2            PRODUCTS**

**2.1                MATERIALS**

- .1        Formwork materials:
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- .1 For concrete without special architectural features, use wood and wood product formwork materials to CSA-O121, CAN/CSA-O86, CSA O437 Series, CSA-O153.
- .2 Rigid insulation board: to CAN/ULC-S701.
- .2 Form ties:
  - .1 Exterior walls for water retaining structures: Coil type with force fit waterstop disc and setback plastic cone that leaves a 50 mm deep hole in the concrete surface for waterproofing grouting.
  - .2 Other structures: removable, tapered or snap-off type of fixed or adjustable length with setback plastic cone that leaves a 25 mm minimum deep hole in concrete surface for grouting.
- .3 Form liner:
  - .1 Plywood: medium density overlay Canadian Softwood Plywood to CSA O151.
- .4 Form release agent: shall not leave a residue, discolour or stain concrete surface. Form release agent shall be compatible with final coating or waterproofing agent if applicable.
  - .1 Acceptable products: RICH-COTE by NCA/ Acrow-Richmond Ltd., Sealtight Duogard by W.R. Meadows of Canada Ltd., Eucoslip VOX by Euclid Admixtures Canada Inc., or approved equal in accordance with B8.
- .5 Form stripping agent: colourless mineral oil, non-toxic, biodegradable, low VOC, free of kerosene, with viscosity between 70 and 110s Saybolt Universal at 40 degrees C, flashpoint minimum 150 degrees C, open cup.
- .6 Falsework materials: to CSA-S269.1.
- .7 Water Stopped Form Ties: For water-holding structures, below grade structures, pipe galleries, and accessible spaces below finish grade, furnish one of the following:
  - .1 Orient water stops perpendicular to tie and symmetrical about center of tie.
  - .2 Design ties to prevent rotation or disturbance of center portion of tie during removal of ends and to prevent water leaking along tie.
  - .3 Through bolt ties are not permitted for water-holding structures.

## **PART 3 EXECUTION**

### **3.1 FABRICATION AND ERECTION**

- .1 Verify lines, levels and centres before proceeding with formwork/falsework and ensure dimensions agree with drawings.
- .2 Fabricate and erect falsework in accordance with CSA S269.1.
- .3 Fabricate and erect formwork in accordance with CAN/CSA-S269.1 to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CSA-A23.1/A23.2.
- .4 Align form joints and make watertight.
  - .1 Keep form joints to minimum.
- .5 Locate horizontal form joints for exposed columns and walls at ceiling line unless shown otherwise.

- .6 Use 25 mm chamfer strips on external corners and/or 25 mm fillets at interior corners, joints, unless specified otherwise.
- .7 Form chases, slots, openings, drips, recesses, expansion and control joints as indicated.
  - .1 Continuous pre-formed flashing reglets to forms where built-in flashings occur at concrete surfaces.
  - .2 PVC waterstops continuous without displacing reinforcement and in accordance with manufacturer's instructions. Heat seal all joints, intersections and splices.
  - .3 Where final work will be exposed to view, set form ties in neat regular patterns.
- .8 Build in anchors, sleeves, and other inserts required to accommodate Work specified in other sections.
  - .1 Ensure that anchors and inserts will not protrude beyond surfaces designated to receive applied finishes, including painting.
- .9 Clean formwork in accordance with CSA-A23.1/A23.2, before placing concrete.

### **3.2 REMOVAL AND RESHORING**

- .1 Leave formwork in place for following minimum periods of time after placing concrete.
  - .1 7 days for walls and sides of beams.
  - .2 7 days for columns.
  - .3 14 days for beam soffits, slabs, decks and other structural members, or 7 days when replaced immediately with adequate shoring to standard specified for falsework.
  - .4 Time periods for walls and beam side forms may be reduced to 3 days if acceptable curing and cold weather protection is provided.
- .2 In cold weather, the minimum time interval may be governed by the requirement for protection of concrete as specified elsewhere in these specifications. Generally, the minimum time interval may be governed by the curing requirements of Section 03 30 00 Cast-In-Place Concrete.
- .3 Remove formwork when concrete has reached 70% of its design strength or minimum period noted above, whichever comes later, and replace immediately with adequate reshoring.
- .4 Provide necessary reshoring of members where early removal of forms may be required or where members may be subjected to additional loads during construction as required.
- .5 Space reshoring in each principal direction at not more than 3000 mm apart.
- .6 Re-use formwork and falsework subject to requirements of CSA-A23.1/A23.2.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1 American Concrete Institute (ACI)
  - .1 SP-66-04, ACI Detailing Manual 2004.
    - .1 ACI 315-99, Details and Detailing of Concrete Reinforcement.
    - .2 ACI 315R-04, Manual of Engineering and Placing Drawings for Reinforced Concrete Structures.
  - .2 ASTM International
    - .1 ASTM A82/A82M-07, Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
    - .2 ASTM A143/A143M-07, Standard Practice for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
    - .3 ASTM A185/A185M-07, Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete.
    - .4 ASTM A775/A775M-07b, Standard Specification for Epoxy-Coated Reinforcing Steel Bars.
  - .3 CSA International
    - .1 CSA-A23.1-09/A23.2-09, Concrete Materials and Methods of Concrete Construction/Test Methods and Standard Practices for Concrete.
    - .2 CAN/CSA-A23.3-04(R2010), Design of Concrete Structures.
    - .3 CSA-G30.18-09, Carbon Steel Bars for Concrete Reinforcement.
    - .4 CSA-G40.20/G40.21-04(R2009), General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
    - .5 CAN/CSA-G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
    - .6 CSA W186-M1990(R2012), Welding of Reinforcing Bars in Reinforced Concrete Construction.
  - .4 Reinforcing Steel Institute of Canada (RSIC)
    - .1 RSIC-2004, Reinforcing Steel Manual of Standard Practice.

**1.2                ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Prepare reinforcement shop drawings in accordance with RSIC Manual of Standard Practice and ACI 315
  - .1 Submit drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
    - .1 Indicate placing of reinforcement and:
      - .1 Bar bending details.
      - .2 Lists.
      - .3 Quantities of reinforcement.
      - .4 Sizes, spacings, locations of reinforcement and mechanical splices if approved by Contract Administrator, with identifying code marks to permit correct placement without reference to structural drawings.

- .5 Indicate sizes, spacings and locations of chairs, spacers and hangers.
- .2 Detail lap lengths and bar development lengths to CAN/CSA-A23.3, unless otherwise indicated.

### **1.3 DELIVERY, STORAGE AND HANDLING**

- .1 Deliver, store and handle materials in accordance with Section 01 61 00 - Common Product Requirements and with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Replace defective or damaged materials with new.

## **Part 2 Products**

### **2.1 MATERIALS**

- .1 Substitute different size bars only if permitted in writing by Contract Administrator.
- .2 Reinforcing steel: billet steel, grade 400, deformed bars to CSA-G30.18, unless indicated otherwise.
- .3 Reinforcing steel: weldable low alloy steel deformed bars to CSA-G30.18.
- .4 Welded steel wire mesh reinforcement: to ASTM A185/A185M.
  - .1 8mm wire diameter 200X200 grid
- .5 Cold-drawn annealed steel wire ties: to ASTM A82/A82M.
- .6 Chairs, bolsters, bar supports, spacers: to CSA-A23.1/A23.2.
- .7 Mechanical splices: subject to approval of Contract Administrator.

### **2.2 FABRICATION**

- .1 Fabricate reinforcing steel in accordance with CSA-A23.1/A23.2 ACI 315 and Reinforcing Steel Manual of Standard Practice by the Reinforcing Steel Institute of Canada.
  - .1 ACI 315R unless indicated otherwise.
- .2 Obtain Contract Administrator's written approval for locations of reinforcement splices other than those shown on placing drawings.
- .3 Upon approval of Contract Administrator, weld reinforcement in accordance with CSA W186.

### **2.3 SOURCE QUALITY CONTROL**

- .1 Upon request, provide Contract Administrator with certified copy of mill test report of reinforcing steel, showing physical and chemical analysis, minimum 4 weeks prior to beginning reinforcing work.
  - .2 Upon request inform Contract Administrator of proposed source of material to be supplied.
-

**Part 3 Execution**

**3.1 FIELD BENDING**

- .1 Do not field bend or field weld reinforcement except where indicated or authorized by Contract Administrator.
- .2 When field bending is authorized, bend without heat, applying slow and steady pressure.
- .3 Replace bars, which develop cracks or splits.

**3.2 PLACING REINFORCEMENT**

- .1 Place reinforcing steel as indicated on placing drawings and in accordance with CSA-A23.1/A23.2.
- .2 Prior to placing concrete, obtain Contract Administrator's approval of reinforcing material and placement.
- .3 Ensure cover to reinforcement is maintained during concrete pour.

**3.3 CLEANING**

- .1 Progress Cleaning: clean in accordance with Section 01 74 11 - Cleaning.

**END OF SECTION**

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**Part 1            General**

**1.1                REFERENCES**

- .1    Abbreviations and Acronyms:
    - .1    Portland Cement: hydraulic cement, blended hydraulic cement (XXb - b denotes blended) and Portland-limestone cement.
      - .1    Type GU, GUb and GUL - General use cement.
      - .2    Type MS and MSb - Moderate sulphate-resistant cement.
      - .3    Type MH, MHb and MHL - Moderate heat of hydration cement.
      - .4    Type HE, HEb and HEL - High early-strength cement.
      - .5    Type LH, LHb and LHL - Low heat of hydration cement.
      - .6    Type HS and HSb - High sulphate-resistant cement.
    - .2    Fly ash:
      - .1    Type F - with CaO content less than 15%. Type CI - with CaO content ranging from 15 to 20%.
      - .2    Type CH - with CaO greater than 20%.
    - .3    GGBFS - Ground, granulated blast-furnace slag.
  
  - .2    Reference Standards:
    - .1    ASTM International
      - .1    ASTM C260/C260M-10a, Standard Specification for Air-Entraining Admixtures for Concrete.
      - .2    ASTM C309-11, Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
      - .3    ASTM C494/C494M-13, Standard Specification for Chemical Admixtures for Concrete.
      - .4    ASTM C1017/C1017M-07, Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
      - .5    ASTM D1752-04a(2008), Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.
    - .2    Canadian General Standards Board (CGSB)
      - .1    CAN/CGSB-37.2-M88, Emulsified Asphalt, Mineral Colloid-Type, Unfilled, for Dampproofing and Waterproofing and for Roof Coatings.
      - .2    CAN/CGSB-51.34-M86(R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.
    - .3    CSA International
      - .1    CSA A23.1/A23.2-09, Concrete Materials and Methods of Concrete Construction/Methods of Test and Standard Practices for Concrete.
      - .2    CSA A283-06, Qualification Code for Concrete Testing Laboratories.
      - .3    CSA A3000-08, Cementitious Materials Compendium (Consists of A3001, A3002, A3003, A3004 and A3005).
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**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
- .2 Provide testing results for review by Contract Administrator and do not proceed without written approval when deviations from mix design or parameters are found.
- .3 Concrete pours: provide accurate records of poured concrete items indicating date and location of pour, quality, air temperature and test samples taken as described in PART 3 - FIELD QUALITY CONTROL.
- .4 Concrete hauling time: provide for review by Contract Administrator deviations exceeding maximum allowable time of 120 minutes for concrete to be delivered to site of Work and discharged after batching.

**1.3 QUALITY ASSURANCE**

- .1 Quality Assurance: in accordance with Section 01 45 00 - Quality Control.
- .2 Provide Contract Administrator, minimum 4 weeks prior to starting concrete work, with valid and recognized certificate from plant delivering concrete.
  - .1 Provide test data and certification by qualified independent inspection and testing laboratory that materials and mix designs used in concrete mixture will meet specified requirements.
- .3 Minimum 4 weeks prior to starting concrete work, provide proposed quality control procedures for review by Contract Administrator on following items:
  - .1 Falsework erection.
  - .2 Hot weather concrete.
  - .3 Cold weather concrete.
  - .4 Curing.
  - .5 Finishes.
- .4 Quality Control Plan: provide written report to Contract Administrator verifying compliance that concrete in place meets performance requirements of concrete as established in PART 2 - PRODUCTS.

**1.4 DELIVERY, STORAGE AND HANDLING**

- .1 Delivery and Acceptance Requirements:
    - .1 Concrete hauling time: deliver to site of Work and discharged within 120 minutes maximum after batching.
      - .1 Do not modify maximum time limit without receipt of prior written agreement from Contract Administrator and concrete producer as described in CSA A23.1/A23.2.
      - .2 Deviations to be submitted for review by Contract Administrator.
    - .2 Concrete delivery: ensure continuous concrete delivery from plant meets CSA A23.1/A23.2.
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**Part 2            Products**

**2.1                DESIGN CRITERIA**

- .1            Alternative 1 - Performance : to CSA A23.1/A23.2, and as described in MIXES of PART 2 - PRODUCTS.

**2.2                PERFORMANCE CRITERIA**

- .1            Quality Control Plan: ensure concrete supplier meets performance criteria of concrete as established by Contract Administrator and provide verification of compliance as described in PART 1 - QUALITY ASSURANCE.
- .2            Portland Cement: to CSA A3001, Type GU.
- .3            Blended hydraulic cement: Type GUB to CSA A3001.
- .4            Supplementary cementing materials: with minimum 20% Type F fly ash replacement N GGBFS, by mass of total cementitious materials to CSA A3001.
- .5            Water: to CSA A23.1.
- .6            Aggregates: to CSA A23.1/A23.2.
- .7            Admixtures:
  - .1            Air entraining admixture: to ASTM C260.
  - .2            Chemical admixture: to ASTM C494 ASTM C1017. Contract Administrator to approve accelerating or set retarding admixtures during cold and hot weather placing.
- .8            Shrinkage compensating grout: premixed compound consisting of non-metallic aggregate, Portland cement, water reducing and plasticizing agents to CSA A23.1/A23.2.
  - .1            Compressive strength: 40 MPa at 28 days.
  - .2            Net shrinkage at 28 days: maximum 0 %.
- .9            Curing compound: to CSA A23.1/A23.2

**2.3                MIXES**

- .1            Ensure concrete supplier meets performance criteria as established below and provide verification of compliance as in Quality Control Plan.
  - .2            Provide concrete mix to meet following hard state requirements:
    - .1            Durability and class of exposure: N
    - .2            Compressive strength at 28 day age: 30 MPa minimum.
    - .3            Intended application: Pipe support pedestal.
    - .4            Water/Cement Ratio (W/C): 0.45
    - .5            Aggregate size 20 mm maximum.
    - .6            Entrained Air: N/A
  - .3            Provide quality management plan to ensure verification of concrete quality to specified performance.
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- .4 Concrete supplier's certification: both batch plant and materials meet CSA A23.1 requirements.

**Part 3 Execution**

**3.1 PREPARATION**

- .1 Obtain Contract Administrator's written approval before placing concrete. Provide 24 hours minimum notice prior to placing of concrete.
- .2 Prepare existing concrete surface to CSP 7 profile (scarify to 6-8mm amplitude). Use methods that do not damage the slab. These include milling machines and shotblasting methods.
- .3 Ensure prepared concrete surface free of debris, dust, oil prior to application of bonding agent.
- .4 Apply bonding agent to prepared concrete surface following manufacturer's instructions. Approved products:
- Sikadur-32 Hi-Mod by Sika Group
  - Intralok by W.R. Meadows
  - MasterEmaco A 660 by BASF
  - Or Approved Equal in Accordance with B8
- .5 During concreting operations:
- .1 Development of cold joints not allowed.
- .2 Ensure concrete delivery and handling facilitates placing with minimum of re-handling, and without damage to existing structure or Work.
- .6 Pumping of concrete is permitted only after approval of equipment and mix.
- .7 Protect previous Work from staining.
- .8 Clean and remove stains prior to application for concrete finishes.
- .9 Maintain accurate records of poured concrete items to indicate date, location of pour, quality, air temperature and test samples taken.
- .10 In locations where new concrete is dowelled to existing work, drill holes in existing concrete.
- .1 Place steel dowels of deformed steel reinforcing bars in drilled holes and pack solidly with epoxy grout to anchor and hold dowels in positions as indicated. Epoxy grout material to be Hilti HIT-HY 200 adhesive system or approved equal in accordance with B8. Install grout as per manufacturer's instructions.

**3.2 INSTALLATION/APPLICATION**

- .1 Do cast-in-place concrete work to CSA A23.1/A23.2.
- .2 Grout under base plates and machinery using procedures in accordance with manufacturer's recommendations which result in 100 % contact over grouted area.

- .3 Finishing and curing:
  - .1 Finish concrete to CSA A23.1/A23.2.
  - .2 Use procedures as noted in CSA A23.1/A23.2] to remove excess bleed water. Ensure surface is not damaged.
  - .3 Use curing compounds compatible with applied finish on concrete surfaces.
  - .4 Finish concrete floor to CSA A23.1/A23.2. Class A.
  - .5 Provide swirl-trowelled finish unless otherwise indicated.
  - .6 Rub exposed sharp edges of concrete with carborundum to produce 3 mm minimum radius edges unless otherwise indicated.

### **3.3 SURFACE TOLERANCE**

- .1 Concrete tolerance to CSA A23.1

### **3.4 FIELD QUALITY CONTROL**

- .1 Site tests: conduct tests as follows:
  - .1 Concrete pours.
  - .2 Slump.
  - .3 Air content.
  - .4 Compressive strength at 7, and 28 days.
  - .5 Air and concrete temperature.
- .2 Inspection and testing of concrete and concrete materials will be carried out by testing laboratory designated by Contract Administrator for review to CSA A23.1/A23.2.
  - .1 Ensure testing laboratory is certified to CSA A283.
- .3 Contractor shall pay for cost of Inspection and Testing.

**END OF SECTION**

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**PART 1 GENERAL**

**1.1 REFERENCES**

- .1 ASTM International Inc.
  - .1 ASTM A36/A36M-08, Standard Specification for Carbon Structural Steel.
  - .2 ASTM A193/A193M-08, Standard Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High-Temperature or High-Pressure Service and Other Special Purpose Applications.
  - .3 ASTM F1554-20, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
  - .4 ASTM A325-14, Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .2 Canadian General Standards Board (CGSB)
  - .1 CAN/CGSB-85.10-99, Protective Coatings for Metals.
- .3 Canadian Institute of Steel Construction (CISC)/Canadian Paint Manufacturers Association (CPMA).
  - .1 Handbook of the Canadian Institute of Steel Construction.
  - .2 CISC/CPMA Standard 2-75, Quick-Drying Primer for use on Structural Steel.
- .4 Canadian Standards Association (CSA International)
  - .1 CSA G40.20/G40.21-04, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.
  - .2 CAN/CSA-G164-M92 (R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.
  - .3 CAN/CSA-S16-14, Limit States Design of Steel Structures.
  - .4 CAN/CSA-S136-07, North American Specifications for the Design of Cold Formed Steel Structural Members.
  - .5 CSA W47.1-03, Certification of Companies for Fusion Welding of Steel.
  - .6 CSA W48-18, Filler Metals and Allied Materials for Metal Arc Welding.
  - .7 CSA W59-18 Welded Steel Construction (Metal Arc Welding).
- .5 Master Painters Institute
  - .1 MPI-INT 5.1-08, Structural Steel and Metal Fabrications.
  - .2 MPI-EXT 5.1-08, Structural Steel and Metal Fabrications.
- .6 The Society for Protective Coatings (SSPC) and National Association of Corrosion Engineers (NACE) International
  - .1 NACE No. 3/SSPC SP-6-06, Commercial Blast Cleaning.

**1.2 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
  - .2 Shop Drawings:
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- .1 Provide drawings stamped and signed by professional engineer registered or licensed in Province of Manitoba, Canada.
  - .3 Erection drawings:
    - .1 Submit erection drawings indicating details and information necessary for assembly and erection purposes.
  - .4 Fabrication drawings:
    - .1 Submit fabrication drawings showing designed assemblies, components and connections are stamped and signed by qualified professional engineer licensed in the Province of Manitoba, Canada.
- 1.3 DELIVERY, STORAGE AND HANDLING**
- .1 Deliver materials in manufacturer's original, undamaged containers with identification labels intact.
- PART 2 PRODUCTS**
- 2.1 DESIGN REQUIREMENTS**
- .1 Design details and connections in accordance with requirements of CAN/CSA-S16 and CAN/CSA-S136 to resist forces, moments, and shears and allow for movements indicated.
  - .2 Shear connections:
    - .1 Select framed beam shear connections from an industry accepted publication such as "Handbook of the Canadian Institute of Steel Construction" when connection for shear only (standard connection) is required.
    - .2 Select or design connections to support reaction from maximum uniformly distributed load that can be safely supported by beam in bending, provided no point loads act on beam, when shears are not indicated.
  - .3 Submit sketches and design calculations stamped and signed by qualified professional engineer licensed in Province of Manitoba, Canada for non-standard connections.
- 2.2 MATERIALS**
- .1 Structural steel: to CSA-G40.20/G40.21 Grade as indicated and/or CAN/CSA-S136.
  - .2 Pipe support posts: to CSA-G40.20/G40.21 (HSS Class C) or ASTM A500 (Grade C)
  - .3 Anchor bolts: to ASTM F1554 Gr. 55. Galvanized
  - .4 Bolts, nuts and washers: to ASTM A325M. Galvanized
  - .5 Welding materials: to CSA W48 Series CSA W59 and certified by Canadian Welding Bureau.
  - .6 Shop paint primer: to CISC/CPMA2-75 solvent reducible alkyd, grey.
- 2.3 FABRICATION**
- .1 Fabricate structural steel in accordance with CAN/CSA-S16 CAN/CSA-S136 and in accordance with reviewed shop drawings.
  - .2 Install shear studs in accordance with CSA W59.
  - .3 Continuously seal members by continuous welds. Grind smooth.
-

## **2.4 SHOP PAINTING**

- .1 Clean, prepare surfaces and shop prime structural steel in accordance with CAN/CSA-S16 except where members to be encased in concrete.
- .2 Clean members; remove loose mill scale, rust, oil, dirt and foreign matter. Prepare surface according to NACE No.3/SSPC-SP-6.
- .3 Apply following primer and finish coat thicknesses:
  - One primer coat Interzinc 52 zinc-rich epoxy or approved equal in accordance with B8 to minimum 2.5 mil DFT
  - One finish coat Intergard 345 high-build epoxy or approved equal in accordance with B8 to minimum 6.0 mil DFT, except for:
    - .1 Surfaces to be encased in concrete.
    - .2 Surfaces and edges to be field welded.
    - .3 Faying surfaces of slip-critical connections.
- .4 Apply paint under cover; on dry surfaces when surface and air temperatures are above 5 degrees C.
- .5 Maintain dry condition and 5 degrees C minimum temperature until paint is thoroughly dry.
- .6 Strip paint from bolts, nuts, sharp edges and corners before prime coat is dry.

## **PART 3 EXECUTION**

### **3.1 APPLICATION**

- .1 Manufacturer's Instructions: comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.

### **3.2 GENERAL**

- .1 Structural steel work: in accordance with CAN/CSA-S16 CAN/CSA-S136.
- .2 Welding: in accordance with CSA W59.
- .3 Companies to be certified under Division 1 or 2.1 of CSA W47.1 for fusion welding of steel structures and/or CSA W55.3 for resistance welding of structural components.

### **3.3 MARKING**

- .1 Mark materials in accordance with CSA G40.20/G40.21. Do not use die stamping. When steel is to be left in unpainted condition, place marking at locations not visible from exterior after erection.
- .2 Match marking: shop mark for fit and match.

### **3.4 ERECTION**

- .1 Erect structural steel, as indicated and in accordance with CAN/CSA-S16 CAN/CSA-S136 and in accordance with reviewed erection drawings.
  - .2 Field cutting or altering structural members: to approval of Contract Administrator.
  - .3 Clean with mechanical brush and touch up shop primer to bolts, rivets, welds and burned or scratched surfaces at completion of erection.
  - .4 Continuously seal members by continuous welds where indicated. Grind smooth.
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**3.5 FIELD PAINTING**

- .1 Touch up damaged surfaces and surfaces without shop coat with primer to NACE No.3/SSPC-SP-6 except as specified otherwise. Apply in accordance: MPI Architectural Painting Specification Manual.
- .2 Touch up finish coat to match finish specified in section 2.4.3

**END OF SECTION**

**Part 1            General**

**1.1                SCOPE**

- .1        Specification covers the requirements for materials, fabrication and erection of above-grade piping and components for the Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) systems. Erection shall consist of complete installation of piping systems as defined by the piping drawings and documents. It includes installation of all piping, piping components, and related examination, inspection and testing.
- .2        Fabrication and erection of piping shall be in accordance with the applicable requirements of Process Piping ASME B31.3, and Canadian and Provincial Acts and Regulations.
- .3        Contractor shall be responsible for obtaining and providing registrations, data reports, certifications, permits and other authorizations required for compliance with codes and regulations. Contractor shall provide such assistance as may be required to enable The City to obtain certification and acceptance of piping systems by the Authority having Jurisdiction.
- .4        Contractor is to have a current QA/QC pressure piping procedure approved by the Authority having jurisdiction.

**1.2                CODES, STANDARDS AND REFERENCES**

- .1        The following codes, standards, and references shall apply except as specified in Specification.
  - .1        Provincial Regulations
    - .1        Boiler and Pressure Vessel Act and Associated Regulations
  - .2        American Society of Mechanical Engineers (ASME)
    - .1        B1.20, Pipe Threads (except Dryseal)
    - .2        B16.25, Buttwelding Ends
    - .3        B31.3, Process Piping
  - .3        Canadian Standards Association (CSA)
    - .1        B51, Boiler, Pressure Vessel and Pressure Piping Code
  - .4        Pipe Fabrication Institute (PFI)
    - .1        ES-3, Fabrication Tolerances
    - .2        ES-24, Pipe Bending Tolerances
    - .3        ES-31, Standard for Protection of Ends of Fabricated Piping Assemblies
  - .5        Steel Structures Painting Council (SSPC)
    - .1        SP-6, Commercial Blast Cleaning
    - .2        SP-10, Near White Metal Blast Cleaning
- .2        Unless otherwise specified, the applicable issue dates of codes, standards, and practices shall be the date of issues in the appendices of ASME B31.3. When a document reference is not included in ASME B31.3, the latest revision of that document shall apply unless otherwise specified.

**1.3                DOCUMENTATION**

- .1        Quality control programs, schedules, procedures, test results, certifications, and affidavits shall be provided as required by the applicable requirements of Process Piping ASME B31.3, and Canadian and Provincial Acts and Regulations.
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## 1.4 DEFINITIONS

- .1 The term pipespool as used in this Specification means a unit of fabricated piping consisting of pipe, fittings, flanges and other components integral to the assembly. Pipespool numbers are assigned to each pipespool and identify a specific pipespool to be fabricated and/or installed by Contractor.

## Part 2 Products

### 2.1 MATERIAL CONTROL, HANDLING AND STORAGE

- .1 Special precautions shall be taken to ensure that all material used for fabrication and installation of boiler external piping is fully documented and available prior to release to fabrication and installation.
- .2 Precautions shall be taken during handling, fabrication, storage, loading, and installation to protect flange surface finishes and all ends from damage. All ends shall be capped when delivered.
- .3 Piping which has been coated with paint prior to erection shall be handled with care to avoid damage to coatings. Slings protected with fabric or hose sleeves shall be used for lifting.
- .4 Shipping protection provided for pipe, pipespools, and piping components shall be visually inspected by Contractor when material is received at the site before unloading from truck. Any damaged or deficient protection shall be brought to the attention of the Contract Administrator for resolution.
- .5 Pipe fabricated in place shall be provided with temporary protection as recommended by PFI Standard ES-31.
- .6 Pipe fabricated by Contractor in his field shop or work area shall be protected in accordance with the minimum requirements of ES-31.

### 2.2 NOTCH TOUGHNESS REQUIREMENTS

- .1 Notch toughness requirements shall be in accordance with ASME B31.3.

### 2.3 SUBSTITUTIONS

- .1 Any material substitution requests shall be submitted in writing to Contract Administrator for approval in accordance with B8. Substitution shall be avoided where the substitution would negate previous weld procedure qualifications accepted by Contract Administrators and/or Authorities having Jurisdiction or would require additional qualification and acceptances.

### 2.4 RAS PIPING AT HPO REACTOR TANK INLETS

- .1 Pipe, DN500: carbon steel, ASTM A53, ERW, XS wall thickness
  - .2 Fittings, DN500: carbon steel, butt-weld, ASTM A234-WPB, XS wall thickness
  - .3 Flanges, DN500: carbon steel, ASTM A105, B16.5, slip-on, 150#, flat-face
    - .1 Flange gaskets: full face, neoprene, 3 mm thick
    - .2 Flange bolting: ASTM A193-B8M Class 2 Type 316 stainless steel bolts, ASTM A194 8M Type 316 stainless steel heavy hex nuts coated with anti-galling compound.
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- .3 Paddle Blanks and Spacers, DN500: stainless steel, ASTM A240 Gr. 316, Class 150, flat face, to ASME B16.48, with attachment for lifting and rigging.
- .4 Couplings, DN500: flexible coupling, ductile iron, ASTM A536 Gr. 65-45-12, epoxy coated, EPDM flush-type gasket, zinc plated carbon steel bolts and heavy hex nuts, with carbon steel pipe ring adapters.
  - .1 Acceptable product: Victaulic Style 44 with Vic-Ring adapters, or approved equal in accordance with B8.
- .5 Drains and vents, DN50:
  - .1 Thredolet, carbon steel, ASTM A105, 3000#.
  - .2 Pipe, carbon steel, ASTM A106-B, ERW, schedule 160, threaded ends.
  - .3 Ball valve, full port, 2 piece, NPT, 316 SS, RTFE seats, 1000 psi WOG at 200 F, blowout-proof stem, lockable lever handle.
  - .4 316 stainless steel threaded plug in valve outlet.
- .6 Interior finish
  - .1 Carbon steel pipe, fittings and flanges shall be internally lined with shop-applied epoxy coating in accordance with AWWA C210. Holiday testing required.
  - .2 Conform to manufacturer requirements regarding:
    - .1 Surface preparation including sand blasting.
    - .2 Conditions under which painting system can be applied.
    - .3 Prime and final coat thicknesses.
  - .3 Acceptable Products: Two (2) prime coats Devoe Bar Rust 236, 6 mil DFT per coat, with Devoe Devgrip 238 abrasion resistant finish coat, 6 mil DFT. Total lining 18 mil DFT or approved equal in accordance with B8.
  - .4 On mechanically-coupled pipe ends with ring adapters, interior finish shall be continuous over end of pipe and ring adapter, up to and including coupling gasket sealing surface.

## 2.5 WAS PIPING

- .1 Pipe, DN150-300: carbon steel, ASTM A53, ERW, XS wall thickness
- .2 Fittings: carbon steel, butt-weld, ASTM A234-WPB, XS wall thickness
- .3 Flanges: carbon steel, ASTM A105, B16.5, slip-on, 150#, flat-face
  - .1 Flange gaskets: full face, neoprene, 3 mm thick
  - .2 Flange bolting: ASTM A193-B8M Class 2 Type 316 stainless steel bolts, ASTM A194 8M Type 316 stainless steel heavy hex nuts coated with anti-galling compound.
- .4 Paddle Blanks and Spacers: stainless steel, ASTM A240 Gr. 316, Class 150, flat face, to ASME B16.48, with attachment for lifting and rigging.
- .5 Drains and vents, DN50:
  - .1 Thredolet, carbon steel, ASTM A105, 3000#.
  - .2 Pipe, carbon steel, ASTM A106-B, ERW, schedule 160, threaded ends.
  - .3 Ball valve, full port, 2 piece, NPT, 316 SS, RTFE seats, 1000 psi WOG at 200 F, blowout-proof stem, lockable lever handle.
  - .4 316 stainless steel threaded plug in valve outlet.

- .6 Interior finish
  - .1 Carbon steel pipe, fittings and flanges shall be internally lined with shop-applied epoxy coating in accordance with AWWA C210. Holiday testing required.
  - .2 Conform to manufacturer requirements regarding:
    - .1 Surface preparation including sand blasting.
    - .2 Conditions under which painting system can be applied.
    - .3 Prime and final coat thicknesses.
  - .3 Acceptable Products: Two (2) prime coats Devoe Bar Rust 236, 6 mil DFT per coat, with Devoe Devgrip 238 abrasion resistant finish coat, 6 mil DFT. Total lining 18 mil DFT or approved equal in accordance with B8.
  - .4 On mechanically-coupled pipe ends with ring adapters, interior finish shall be continuous over end of pipe and ring adapter, up to and including coupling gasket sealing surface.

**2.6 WELDED CARBON STEEL SLEEVES FOR CFRP TERMINATIONS AT FLANGES**

- .1 Sleeves: Rolled plate or STD schedule pipe with diameter and wall thickness sized per detail drawings provided shall be
  - .1 Piping: ASTM A53 ERW carbon steel pipe
  - .2 Rolled Plate: ASTM A36 hot rolled low-carbon steel plate

**2.7 EXTERIOR FINISH AND IDENTIFICATION FOR ALL REPLACED PIPING**

- .1 Exterior finish of all piping to be replaced shall be:
  - .1 Apply epoxy finish to the exterior of all carbon steel or ductile iron piping components in accordance with AWWA C210.
  - .2 Provide a 3 year warranty from project substantial performance date for entire painting system.
  - .3 Conform to manufacturer requirements regarding:
    - .1 Surface preparation including sand blasting.
    - .2 Conditions under which painting system can be applied.
    - .3 Prime and final coat thicknesses.
  - .4 Piping shall be identified per existing identification standard indicating the product and direction of flow. Provide white lettering / arrows on piping painted black. Provide black lettering / arrows on all other background colours.
- .2 Colour Legend:
  - .1 The exterior final coat color of all piping to be replaced or refurbished shall match the existing piping. Refer to the below Colour Legend for the Sherwin Williams Paint Code and colour type to match.

ITEM	COLOUR NAME	SHERWIN WILLIAMS PAINT CODE
RAS Train 1	Pineapple Cream	SW 1668
RAS Train 2	Invigorate (Orange)	SW 6886
RAS Train 3	Drift of Mist (Cream)	SW 9166
RAS Trains 1-3 in HPO Gallery	Black – match existing	-
Waste Activated Sludge	Tricorn Black	SW 6258

- .2 Refer to the City of Winnipeg RFP NO. 384-2020, Appendix R, in full, for deviations and WWD standard paint colours of items that are not present in the Colour Legend.

- .3 Acceptable Product: Two (2) coats Devco Bar Rust 235, 6 mil DFT per coat or approved equal in accordance with B8.

### **Part 3 Execution**

#### **3.1 FABRICATION**

- .1 The piping drawings and documents identify the standard components to be included in fabricated piping such as flanges and fittings.
- .2 Drawings
  - .1 Detail drawings made by Contractor for pipespools or assemblies shall include all necessary information, including but not limited to the following:
    - .1 Dimensions
    - .2 Weld Locations
    - .3 Branch Type
    - .4 Integral Attachments
    - .5 List of Materials
    - .6 Welding Processes
    - .7 Welding Procedure Numbers
    - .8 Welding Filler Metal
    - .9 Preheat and Postweld Heat Treatment
    - .10 Special Cleaning
    - .11 Painting Requirements
    - .12 NDT and other Special Requirements
    - .13 ASME B31.3 Identification if applicable
    - .14 Pipespool or Assembly Number
  - .3 Accuracy
    - .1 Contractor is responsible for the accuracy of his shop detail drawings and of his fabrication. Contract Administrator approval is not required for shop details.
  - .4 Tolerances
    - .1 Pipespool tolerances shall be as defined in PFI Standards ES-3 and ES-24 except as noted below.
    - .2 Alignment of flange faces or ends prepared for welding by others shall not deviate from the indicated position measured across any diameter by more than 0.8 mm (1/32").
  - .5 Branch Connections
    - .1 Lines that connect to a main line or header, including instrument connections, vents, and drains, are considered branch lines. The type of branch connections selected shall be in accordance with the piping material specifications.
    - .2 Required reinforcement shall be clearly identified on piping drawings and documents.
    - .3 Material for branch reinforcement shall be of the same composition as the base material of the pipe. It shall meet the notch toughness and other applicable requirements specified for the pipe to which it is attached.
    - .4 Fabricated branch connections shall be directly joined to the header with full penetration welds. Reinforcing pads, if required, shall be added after visual

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- inspection, other required inspections, and completion and acceptance of any repairs.
- .5 Reinforcing pads or saddles shall be provided with 1/4 NPT vent holes. If the pad or saddle is provided in more than one piece, each piece shall be provided with a 1/4 NPT vent. Insulated piping ventholes shall be fitted with 1/4 inch std wt nipples, length to extend 1" beyond final insulation.
  - .6 Branch connections shall not be installed over girth welds.
  - .7 Particular care shall be taken to provide proper root gaps and welds at weldolets, elbolets, sockolets, and threadolets as recommended by the manufacturers installation procedures.
- .6 Pipe
- .1 Longitudinal seams in adjoining lengths of welded pipe shall be staggered and located to clear openings and external attachments.
  - .2 Pipe lengths used in spool fabrication shall be selected to minimize field welds. When necessary to use more than one length of pipe in a straight section of spool, the shortest length shall not be less than 300 mm (12") or one pipe diameter whichever is greater. Heat affected zones shall not be touching.
- .7 Flanges
- .1 Protection of flange face surface finish is required. Precautions shall be taken throughout handling and fabrication operations to protect the gasket surface finish of the flanges.
- .8 Joint Preparation
- .1 The use of backing rings is strictly prohibited.
  - .2 Threaded Joints
    - .1 Threaded joints shall be tapered pipe threads in accordance with ASME B1.20. Threaded connections in pieces requiring heat treatment shall be protected from damage by heat. Where threaded couplings or nipples are welded to pipespools, the thread must be checked for fit and roundness after welding or heat treatment by using a thread gauge. If threads are not acceptable, chase the threads with a tap or die. Clean the threads with cutting oil and a suitable solvent.
  - .3 Socket Weld Joints
    - .1 Weld dimensions and gaps for socket welding pipe joints shall not be less than the minimum requirements of ASME B31.1 and B31.3. The gap between pipe end and fitting shall not exceed 3 mm (1/8") after welding.
- .9 Welding and Post-Weld Heat Treatment
- .1 Welding and post-weld heat treatment shall be in accordance with this Specification, and satisfy requirements of the codes and regulatory agencies having jurisdiction over the work. Welding shall be in accordance with approved welding procedures registered by or acceptable to the Authority having Jurisdiction.
  - .2 Welding shall be performed by certified welders or welding machine operators holding a current pressure welders authorization issued by or acceptable to the Authority having Jurisdiction. The welder or welding machine operator shall not perform welding utilizing procedure for which he has not been duly authorized.
  - .3 Submit Welding Procedure Specifications (WPS), and matching Procedure Qualification Records (PQR), to Contract Administrator for approval. Procedures shall not be submitted for approval until they have been registered with or accepted by the Authority having Jurisdiction. Evidence of this registration or acceptance shall accompany each WPS and PQR submitted to Contract Administrator.
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- .4 Welding shall not be performed on any line that has been postweld heat treated.
- .10 Cleaning
  - .1 After completion of fabrication and heat treatment, piping shall be free of loose scale, weld spatter, sand, chips, oil, grease, and other foreign material. Each pipespool shall be visually inspected to ensure proper cleanliness.
- .11 Welded Carbon Steel Sleeves for CFRP Terminations at Flanges
  - .1 Welded carbon steel sleeves for termination of the CFRP wrap shall be fabricated and connected to the in-service RAS system piping in accordance with the requirements of ASME PCC-2 Article 2.10, including:
    - .1 Weld Procedures and Welder Qualifications
      - .1 Welding procedures and welders shall be qualified using the setup detailed in Mandatory Appendix I and testing requirements outlined in paragraph 4.2.
    - .2 Examination
      - .1 All in-service welds made in the field shall be examined for hydrogen cracking after welding by magnetic particle or liquid penetrant methods in accordance with ASME B31.3, paragraphs 344.3 or 344.4. Welds shall be examined 24 hr to 72 hr after welding has been completed.

### 3.2 **INSTALLATION**

- .1 Submit procedure for bolting of flanged joints to Contract Administrator for approval. Contractor shall be responsible for completeness of his procedure, and shall not perform bolting operations until the procedure is approved. Procedure shall include bolt lubrication and preservation proposed for use in assembly.
  - .2 Pipe, pipespools, and in-line components shall be inspected internally for foreign material during final installation. Material shall be removed prior to installation and bolting or welding in place.
  - .3 End protectors shall not be removed from piping and equipment until ready for final connection. Weld end and gasket surfaces shall be inspected for damage when covers are removed. Contract Administrator shall be informed of any damage. Repairs shall not be made without approval of Contract Administrator.
  - .4 Gaskets shall be protected from damage until final installation is completed.
  - .5 Piping shall be properly supported to prevent excessive deflection during handling and installation.
  - .6 Permanent deformation resulting from improper handling shall be brought to the attention of Contract Administrator for resolution.
  - .7 Bolting - The use of washers or other packing to use up excessive length of flange bolts is not acceptable. The length of machine and stud bolts shall be such that nuts are fully engaged with a minimum of two full threads protruding and that studs are centered.
  - .8 Bolting shall be checked for proper grade and marking prior to installation. Bolting not properly identified with the required ASTM material grade shall not be used.
  - .9 Threaded joints shall be made up using thread compounds or teflon tape.
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- .10 No thread compounds or teflon tape shall be used on threaded joints which are to be seal welded. Plugged connections shall be checked during erection to ensure the plugs comply with line class requirements.
- .11 Supports, guides, anchors, pads, and other appurtenances shall be installed as required by the piping drawings. Field installed pads on random piping shall be provided with vent holes.

### **3.3 INSPECTION AND TESTING**

- .1 All Inspection and testing shall:
  - .1 Be in accordance with ASME B31.3, Category D fluid service.
  - .2 Be performed by a specialist qualified in accordance with CSA 178.1 and 178.2.
  - .3 Include detailed weld inspection reports to Contract Administrator.
- .2 Acceptance criteria for visual and radiographic weld inspection shall follow ASME B31.3, para. 341.3.2, Table 341.3.2. Any rejected welds shall be repaired or replaced.
- .3 Acceptance criteria for magnetic particle examination shall follow ASME B31.3, para 344.3.2. Any rejected welds shall be repaired or replaced.
- .4 Magnetic particle examination providers shall be certified in accordance with CAN/CGSB-48.9712.
- .5 Shop fabricated pipe spools shall be hydrostatically pressure tested to 1379 kPag (200 psig) at the Contractor's fabrication shop.
- .6 Perform inspection and testing prior to painting.
- .7 Installed piping shall be leak tested and examined in service. Contract Administrator shall be informed of any leaks. Repairs shall not be made without approval of Contract Administrator.

**END OF SECTION**

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**Part 1            General**

**1.1                SCOPE**

- .1        Specification covers the requirements for materials, fabrication and erection of above-grade piping and components for the Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) systems. Erection shall consist of complete installation of piping systems as defined by the piping drawings and documents. It includes installation of all piping, piping components, and related examination, inspection and testing.
- .2        Fabrication and erection of piping shall be in accordance with the applicable requirements of Process Piping ASME B31.3, and Canadian and Provincial Acts and Regulations.
- .3        Contractor shall be responsible for obtaining and providing registrations, data reports, certifications, permits and other authorizations required for compliance with codes and regulations. Contractor shall provide such assistance as may be required to enable The City to obtain certification and acceptance of piping systems by the Authority having Jurisdiction.
- .4        Contractor is to have a current QA/QC pressure piping procedure approved by the Authority having jurisdiction.

**1.2                CODES, STANDARDS AND REFERENCES**

- .1        The following codes, standards, and references shall apply except as specified in Specification.
  - .1        Provincial Regulations
    - .1        Boiler and Pressure Vessel Act and Associated Regulations
  - .2        American Society of Mechanical Engineers (ASME)
    - .1        B1.20, Pipe Threads (except Dryseal)
    - .2        B16.25, Buttwelding Ends
    - .3        B31.3, Process Piping
  - .3        Canadian Standards Association (CSA)
    - .1        B51, Boiler, Pressure Vessel and Pressure Piping Code
  - .4        Pipe Fabrication Institute (PFI)
    - .1        ES-3, Fabrication Tolerances
    - .2        ES-24, Pipe Bending Tolerances
    - .3        ES-31, Standard for Protection of Ends of Fabricated Piping Assemblies
  - .5        Steel Structures Painting Council (SSPC)
    - .1        SP-6, Commercial Blast Cleaning
    - .2        SP-10, Near White Metal Blast Cleaning
- .2        Unless otherwise specified, the applicable issue dates of codes, standards, and practices shall be the date of issues in the appendices of ASME B31.3. When a document reference is not included in ASME B31.3, the latest revision of that document shall apply unless otherwise specified.

**1.3                DOCUMENTATION**

- .1        Quality control programs, schedules, procedures, test results, certifications, and affidavits shall be provided as required by the applicable requirements of Process Piping ASME B31.3, and Canadian and Provincial Acts and Regulations.
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## 1.4 DEFINITIONS

- .1 The term pipespool as used in this Specification means a unit of fabricated piping consisting of pipe, fittings, flanges and other components integral to the assembly. Pipespool numbers are assigned to each pipespool and identify a specific pipespool to be fabricated and/or installed by Contractor.

## Part 2 Products

### 2.1 MATERIAL CONTROL, HANDLING AND STORAGE

- .1 Special precautions shall be taken to ensure that all material used for fabrication and installation of boiler external piping is fully documented and available prior to release to fabrication and installation.
- .2 Precautions shall be taken during handling, fabrication, storage, loading, and installation to protect flange surface finishes and all ends from damage. All ends shall be capped when delivered.
- .3 Piping which has been coated with paint prior to erection shall be handled with care to avoid damage to coatings. Slings protected with fabric or hose sleeves shall be used for lifting.
- .4 Shipping protection provided for pipe, pipespools, and piping components shall be visually inspected by Contractor when material is received at the site before unloading from truck. Any damaged or deficient protection shall be brought to the attention of the Contract Administrator for resolution.
- .5 Pipe fabricated in place shall be provided with temporary protection as recommended by PFI Standard ES-31.
- .6 Pipe fabricated by Contractor in his field shop or work area shall be protected in accordance with the minimum requirements of ES-31.

### 2.2 NOTCH TOUGHNESS REQUIREMENTS

- .1 Notch toughness requirements shall be in accordance with ASME B31.3.

### 2.3 SUBSTITUTIONS

- .1 Any material substitution requests shall be submitted in writing to Contract Administrator for approval in accordance with B8. Substitution shall be avoided where the substitution would negate previous weld procedure qualifications accepted by Contract Administrators and/or Authorities having Jurisdiction or would require additional qualification and acceptances.

### 2.4 RAS PIPING AT HPO REACTOR TANK INLETS

- .1 Pipe, DN500: carbon steel, ASTM A53, ERW, XS wall thickness
  - .2 Fittings, DN500: carbon steel, butt-weld, ASTM A234-WPB, XS wall thickness
  - .3 Flanges, DN500: carbon steel, ASTM A105, B16.5, slip-on, 150#, flat-face
    - .1 Flange gaskets: full face, neoprene, 3 mm thick
    - .2 Flange bolting: ASTM A193-B8M Class 2 Type 316 stainless steel bolts, ASTM A194 8M Type 316 stainless steel heavy hex nuts coated with anti-galling compound.
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- .3 Paddle Blanks and Spacers, DN500: stainless steel, ASTM A240 Gr. 316, Class 150, flat face, to ASME B16.48, with attachment for lifting and rigging.
- .4 Couplings, DN500: flexible coupling, ductile iron, ASTM A536 Gr. 65-45-12, epoxy coated, EPDM flush-type gasket, zinc plated carbon steel bolts and heavy hex nuts, with carbon steel pipe ring adapters.
  - .1 Acceptable product: Victaulic Style 44 with Vic-Ring adapters, or approved equal in accordance with B8.
- .5 Drains and vents, DN50:
  - .1 Thredolet, carbon steel, ASTM A105, 3000#.
  - .2 Pipe, carbon steel, ASTM A106-B, ERW, schedule 160, threaded ends.
  - .3 Ball valve, full port, 2 piece, NPT, 316 SS, RTFE seats, 1000 psi WOG at 200 F, blowout-proof stem, lockable lever handle.
  - .4 316 stainless steel threaded plug in valve outlet.
- .6 Interior finish
  - .1 Carbon steel pipe, fittings and flanges shall be internally lined with shop-applied epoxy coating in accordance with AWWA C210. Holiday testing required.
  - .2 Conform to manufacturer requirements regarding:
    - .1 Surface preparation including sand blasting.
    - .2 Conditions under which painting system can be applied.
    - .3 Prime and final coat thicknesses.
  - .3 Acceptable Products: Two (2) prime coats Devoe Bar Rust 236, 6 mil DFT per coat, with Devoe Devgrip 238 abrasion resistant finish coat, 6 mil DFT. Total lining 18 mil DFT or approved equal in accordance with B8.
  - .4 On mechanically-coupled pipe ends with ring adapters, interior finish shall be continuous over end of pipe and ring adapter, up to and including coupling gasket sealing surface.

## 2.5 WAS PIPING

- .1 Pipe, DN150-300: carbon steel, ASTM A53, ERW, XS wall thickness
- .2 Fittings: carbon steel, butt-weld, ASTM A234-WPB, XS wall thickness
- .3 Flanges: carbon steel, ASTM A105, B16.5, slip-on, 150#, flat-face
  - .1 Flange gaskets: full face, neoprene, 3 mm thick
  - .2 Flange bolting: ASTM A193-B8M Class 2 Type 316 stainless steel bolts, ASTM A194 8M Type 316 stainless steel heavy hex nuts coated with anti-galling compound.
- .4 Paddle Blanks and Spacers: stainless steel, ASTM A240 Gr. 316, Class 150, flat face, to ASME B16.48, with attachment for lifting and rigging.
- .5 Drains and vents, DN50:
  - .1 Thredolet, carbon steel, ASTM A105, 3000#.
  - .2 Pipe, carbon steel, ASTM A106-B, ERW, schedule 160, threaded ends.
  - .3 Ball valve, full port, 2 piece, NPT, 316 SS, RTFE seats, 1000 psi WOG at 200 F, blowout-proof stem, lockable lever handle.
  - .4 316 stainless steel threaded plug in valve outlet.

- .6 Interior finish
  - .1 Carbon steel pipe, fittings and flanges shall be internally lined with shop-applied epoxy coating in accordance with AWWA C210. Holiday testing required.
  - .2 Conform to manufacturer requirements regarding:
    - .1 Surface preparation including sand blasting.
    - .2 Conditions under which painting system can be applied.
    - .3 Prime and final coat thicknesses.
  - .3 Acceptable Products: Two (2) prime coats Devoe Bar Rust 236, 6 mil DFT per coat, with Devoe Devgrip 238 abrasion resistant finish coat, 6 mil DFT. Total lining 18 mil DFT or approved equal in accordance with B8.
  - .4 On mechanically-coupled pipe ends with ring adapters, interior finish shall be continuous over end of pipe and ring adapter, up to and including coupling gasket sealing surface.

**2.6 WELDED CARBON STEEL SLEEVES FOR CFRP TERMINATIONS AT FLANGES**

- .1 Sleeves: Rolled plate or STD schedule pipe with diameter and wall thickness sized per detail drawings provided shall be
  - .1 Piping: ASTM A53 ERW carbon steel pipe
  - .2 Rolled Plate: ASTM A36 hot rolled low-carbon steel plate

**2.7 EXTERIOR FINISH AND IDENTIFICATION FOR ALL REPLACED PIPING**

- .1 Exterior finish of all piping to be replaced shall be:
  - .1 Apply epoxy finish to the exterior of all carbon steel or ductile iron piping components in accordance with AWWA C210.
  - .2 Provide a 3 year warranty from project substantial performance date for entire painting system.
  - .3 Conform to manufacturer requirements regarding:
    - .1 Surface preparation including sand blasting.
    - .2 Conditions under which painting system can be applied.
    - .3 Prime and final coat thicknesses.
  - .4 Piping shall be identified per existing identification standard indicating the product and direction of flow. Provide white lettering / arrows on piping painted black. Provide black lettering / arrows on all other background colours.
- .2 Colour Legend:
  - .1 The exterior final coat color of all piping to be replaced or refurbished shall match the existing piping. Refer to the below Colour Legend for the Sherwin Williams Paint Code and colour type to match.

ITEM	COLOUR NAME	SHERWIN WILLIAMS PAINT CODE
RAS Train 1	Pineapple Cream	SW 1668
RAS Train 2	Invigorate (Orange)	SW 6886
RAS Train 3	Drift of Mist (Cream)	SW 9166
RAS Trains 1-3 in HPO Gallery	Black – match existing	-
Waste Activated Sludge	Tricorn Black	SW 6258

- .2 Refer to the City of Winnipeg RFP NO. 384-2020, Appendix R, in full, for deviations and WWD standard paint colours of items that are not present in the Colour Legend.

- .3 Acceptable Product: Two (2) coats Devco Bar Rust 235, 6 mil DFT per coat or approved equal in accordance with B7.

### **Part 3 Execution**

#### **3.1 FABRICATION**

- .1 The piping drawings and documents identify the standard components to be included in fabricated piping such as flanges and fittings.
- .2 Drawings
  - .1 Detail drawings made by Contractor for pipespools or assemblies shall include all necessary information, including but not limited to the following:
    - .1 Dimensions
    - .2 Weld Locations
    - .3 Branch Type
    - .4 Integral Attachments
    - .5 List of Materials
    - .6 Welding Processes
    - .7 Welding Procedure Numbers
    - .8 Welding Filler Metal
    - .9 Preheat and Postweld Heat Treatment
    - .10 Special Cleaning
    - .11 Painting Requirements
    - .12 NDT and other Special Requirements
    - .13 ASME B31.3 Identification if applicable
    - .14 Pipespool or Assembly Number
  - .3 Accuracy
    - .1 Contractor is responsible for the accuracy of his shop detail drawings and of his fabrication. Contract Administrator approval is not required for shop details.
  - .4 Tolerances
    - .1 Pipespool tolerances shall be as defined in PFI Standards ES-3 and ES-24 except as noted below.
    - .2 Alignment of flange faces or ends prepared for welding by others shall not deviate from the indicated position measured across any diameter by more than 0.8 mm (1/32").
  - .5 Branch Connections
    - .1 Lines that connect to a main line or header, including instrument connections, vents, and drains, are considered branch lines. The type of branch connections selected shall be in accordance with the piping material specifications.
    - .2 Required reinforcement shall be clearly identified on piping drawings and documents.
    - .3 Material for branch reinforcement shall be of the same composition as the base material of the pipe. It shall meet the notch toughness and other applicable requirements specified for the pipe to which it is attached.
    - .4 Fabricated branch connections shall be directly joined to the header with full penetration welds. Reinforcing pads, if required, shall be added after visual

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- inspection, other required inspections, and completion and acceptance of any repairs.
- .5 Reinforcing pads or saddles shall be provided with 1/4 NPT vent holes. If the pad or saddle is provided in more than one piece, each piece shall be provided with a 1/4 NPT vent. Insulated piping ventholes shall be fitted with 1/4 inch std wt nipples, length to extend 1" beyond final insulation.
  - .6 Branch connections shall not be installed over girth welds.
  - .7 Particular care shall be taken to provide proper root gaps and welds at weldolets, elbolets, sockolets, and threadolets as recommended by the manufacturers installation procedures.
- .6 Pipe
- .1 Longitudinal seams in adjoining lengths of welded pipe shall be staggered and located to clear openings and external attachments.
  - .2 Pipe lengths used in spool fabrication shall be selected to minimize field welds. When necessary to use more than one length of pipe in a straight section of spool, the shortest length shall not be less than 300 mm (12") or one pipe diameter whichever is greater. Heat affected zones shall not be touching.
- .7 Flanges
- .1 Protection of flange face surface finish is required. Precautions shall be taken throughout handling and fabrication operations to protect the gasket surface finish of the flanges.
- .8 Joint Preparation
- .1 The use of backing rings is strictly prohibited.
  - .2 Threaded Joints
    - .1 Threaded joints shall be tapered pipe threads in accordance with ASME B1.20. Threaded connections in pieces requiring heat treatment shall be protected from damage by heat. Where threaded couplings or nipples are welded to pipespools, the thread must be checked for fit and roundness after welding or heat treatment by using a thread gauge. If threads are not acceptable, chase the threads with a tap or die. Clean the threads with cutting oil and a suitable solvent.
  - .3 Socket Weld Joints
    - .1 Weld dimensions and gaps for socket welding pipe joints shall not be less than the minimum requirements of ASME B31.1 and B31.3. The gap between pipe end and fitting shall not exceed 3 mm (1/8") after welding.
- .9 Welding and Post-Weld Heat Treatment
- .1 Welding and post-weld heat treatment shall be in accordance with this Specification, and satisfy requirements of the codes and regulatory agencies having jurisdiction over the work. Welding shall be in accordance with approved welding procedures registered by or acceptable to the Authority having Jurisdiction.
  - .2 Welding shall be performed by certified welders or welding machine operators holding a current pressure welders authorization issued by or acceptable to the Authority having Jurisdiction. The welder or welding machine operator shall not perform welding utilizing procedure for which he has not been duly authorized.
  - .3 Submit Welding Procedure Specifications (WPS), and matching Procedure Qualification Records (PQR), to Contract Administrator for approval. Procedures shall not be submitted for approval until they have been registered with or accepted by the Authority having Jurisdiction. Evidence of this registration or acceptance shall accompany each WPS and PQR submitted to Contract Administrator.
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- .4 Welding shall not be performed on any line that has been postweld heat treated.
- .10 Cleaning
  - .1 After completion of fabrication and heat treatment, piping shall be free of loose scale, weld spatter, sand, chips, oil, grease, and other foreign material. Each pipespool shall be visually inspected to ensure proper cleanliness.
- .11 Welded Carbon Steel Sleeves for CFRP Terminations at Flanges
  - .1 Welded carbon steel sleeves for termination of the CFRP wrap shall be fabricated and connected to the in-service RAS system piping in accordance with the requirements of ASME PCC-2 Article 210, including:
    - .1 Weld Procedures
    - .2 Welder Qualifications
    - .3 Examination
  - .2 10% of welded carbon steel sleeves shall be subject to magnetic particle non-destructive inspection/examination in accordance with the requirements of subsection 3.3 Inspection below.

### **3.2 INSTALLATION**

- .1 Submit procedure for bolting of flanged joints to Contract Administrator for approval. Contractor shall be responsible for completeness of his procedure, and shall not perform bolting operations until the procedure is approved. Procedure shall include bolt lubrication and preservation proposed for use in assembly.
- .2 Pipe, pipespools, and in-line components shall be inspected internally for foreign material during final installation. Material shall be removed prior to installation and bolting or welding in place.
- .3 End protectors shall not be removed from piping and equipment until ready for final connection. Weld end and gasket surfaces shall be inspected for damage when covers are removed. Contract Administrator shall be informed of any damage. Repairs shall not be made without approval of Contract Administrator.
- .4 Gaskets shall be protected from damage until final installation is completed.
- .5 Piping shall be properly supported to prevent excessive deflection during handling and installation.
- .6 Permanent deformation resulting from improper handling shall be brought to the attention of Contract Administrator for resolution.
- .7 Bolting - The use of washers or other packing to use up excessive length of flange bolts is not acceptable. The length of machine and stud bolts shall be such that nuts are fully engaged with a minimum of two full threads protruding and that studs are centered.
- .8 Bolting shall be checked for proper grade and marking prior to installation. Bolting not properly identified with the required ASTM material grade shall not be used.
- .9 Threaded joints shall be made up using thread compounds or teflon tape.
- .10 No thread compounds or teflon tape shall be used on threaded joints which are to be seal welded. Plugged connections shall be checked during erection to ensure the plugs comply with line class requirements.

- .11 Supports, guides, anchors, pads, and other appurtenances shall be installed as required by the piping drawings. Field installed pads on random piping shall be provided with vent holes.

### **3.3 INSPECTION AND TESTING**

- .1 All Inspection and testing shall:
  - .1 Be in accordance with ASME B31.3, Category D fluid service.
  - .2 Be performed by a specialist qualified in accordance with CSA 178.1 and 178.2.
  - .3 Include detailed weld inspection reports to Contract Administrator.
- .2 Acceptance criteria for visual and radiographic weld inspection shall follow ASME B31.3, para. 341.3.2, Table 341.3.2. Any rejected welds shall be repaired or replaced.
- .3 Acceptance criteria for magnetic particle examination shall follow ASME B31.3, para 344.3.2. Any rejected welds shall be repaired or replaced.
- .4 Magnetic particle examination providers shall be certified in accordance with CAN/CGSB-48.9712.
- .5 Shop fabricated pipe spools shall be hydrostatically pressure tested to 1379 kPag (200 psig) at the Contractor's fabrication shop.
- .6 Perform inspection and testing prior to painting.
- .7 Installed piping shall be leak tested and examined in service. Contract Administrator shall be informed of any leaks. Repairs shall not be made without approval of Contract Administrator.

**END OF SECTION**

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**Part 1            General**

**1.1    SCOPE OF WORK**

- .1    Supply, installation, and commissioning of valves as specified herein.
- .2    Delivery lead time the valves shall not exceed eight (8) weeks.

**1.2    RELATED REQUIREMENTS**

- .1    Section 23 05 05 Piping

**1.3    REFERENCE STANDARDS**

- .1    American National Standards Institute (ANSI)/American Society of Mechanical Engineers (ASME)
  - .1    ASME B16, Fittings and Valves Package.
  - .2    ASME B16.5-[2009], Pipe Flanges and Flanged Fittings: NPS ½ through NPS 24 Metric/Inch Standard.
  - .3    ANSI/ASME B16.10-[2009], Face-to-Face and End-to-End Dimensions Valves.
  - .4    ANSI/ASME B16.34-[2009], Valves Flanged, Threaded and Welding End. Includes Supplement (2010).
- .2    ASTM International
  - .1    ASTM A182/A182M-[11a], Standard Specification for Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valve Parts for High Temperature Service.
  - .2    ASTM A193/A193M-[12], Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.
  - .3    ASTM A194/A194M-[2011], Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both.
  - .4    ASTM A216/A216M-[08], Standard Specification for Steel Castings, Carbon Suitable for Fusion Welding for High-Temperature Service.
- .3    Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
  - .1    MSS SP-25, Standard Marking System for Valves, Fittings, Flanges and Unions.
  - .2    MSS SP-81 Stainless-Steel or Stainless-Steel-Lined, Bonnetless, Knife Gate Valves with Flanged Ends
  - .3    MSS SP-151, Pressure Testing of Knife Gate Valves.

**1.4    ACTION AND INFORMATIONAL SUBMITTALS**

- .1    Submit in accordance with Section 01 33 00- Submittal Procedures.
  - .2    Product Data:
    - .1    Submit manufacturer's instructions, printed product literature and data sheets for each valve and include product characteristics, performance criteria, physical size, finish and limitations.
  - .3    Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
-

## 1.5 CLOSEOUT SUBMITTALS

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Operation and Maintenance Data: submit operation and maintenance data for all new valves for incorporation into manual.

## 1.6 DELIVERY, STORAGE AND HANDLING

- .1 Deliver, store and handle materials in accordance with manufacturer's written instructions.
- .2 Delivery and Acceptance Requirements: deliver materials to site in original factory packaging, labelled with manufacturer's name and address.
- .3 Storage and Handling Requirements:
  - .1 Store materials in dry location, off ground, indoors, and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.
  - .2 Store and protect valves, from nicks, scratches, and blemishes.
  - .3 Replace defective or damaged materials with new.
- .4 Packaging Waste Management: Dispose of off site.

## 1.7 MAINTENANCE MATERIAL SUBMITTALS

- .1 Submit in accordance with Section 01 78 00- Closeout Submittals.
- .2 Extra Stock Materials:
- .3 Furnish following spare parts:
  - .1 Valve seats: one for every 10 valves each size, minimum 1.
  - .2 Stem packing: one for every 10 valves, each size. Minimum 1.

## Part 2 Products

### 2.1 MATERIAL

- .1 Valves:
    - .1 To be of single manufacturer according to valve type
    - .2 Test valves individually.
  - .2 Requirements common to valves, unless specified otherwise:
    - .1 Pressure-temperature ratings: to ANSI B16.34.
    - .2 Flanged valves:
      - .1 Flange dimensions: to ANSI B16.5
    - .3 Markings: to MSS SP-25.
    - .4 Identification:
      - .1 Plate showing catalogue number, size, material of body disc, stem seat, fluid, pressure-temperature rating.
      - .2 Body markings: manufacturer, size, primary service rating, material symbol.
-

## 2.2 KNIFE GATE VALVES

- .1 Service: Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) isolation
  - .2 Type: bonnetless knife gate with bi-directional resilient seat, designed and manufactured to MSS SP-81.
  - .3 Body: cast 316 stainless steel,
  - .4 Gate: 316 stainless steel
  - .5 Flanged ends, drilled and tapped to suit ASME B16.5 Class 150
  - .6 Face to face: MSS SP-81
  - .7 Rated shutoff pressure: 1034 kPag (150 psig), tested to MSS SP-151.
  - .8 Resilient seat to provide bi-directional drip tight seal across gate from zero to full rated shutoff pressure and dead-end service.
    - .1 Seat material: NBR or EPDM.
  - .9 Packing system: 316 stainless steel packing gland with PTFE or PTFE impregnated synthetic fiber.
  - .10 Yoke: cast 304 stainless steel or epoxy-coated WCB carbon steel
  - .11 Stem: 304 stainless steel
  - .12 Manual Actuator: chain wheel
    - .1 Chains shall be galvanized steel with length to fall within 1m from floor or operating level.
    - .2 Gearbox shall be provided when handwheel rim pull force exceeds 36 kg (80 lb).
  - .13 Valve shall be installable and operational in horizontal flow configuration, with valve stem horizontal, without impact to valve performance.
  - .14 Acceptable Manufacturer: Bray, DeZurik, Pratt, Trueline or approved substitute in accordance with B8
  - .15 Knife Gate Valve List
-

VALVE TAG	SIZE	LOCATION – Refer to Drawings and 3D Model
R810-KV-1A	DN500 (20")	RAS 1 - HPO Reactor 1A
R815-KV-1B	DN500 (20")	RAS 1 - HPO Reactor 1B
R820-KV-2A	DN500 (20")	RAS 2 - HPO Reactor 2A
R825-KV-2B	DN500 (20")	RAS 2 - HPO Reactor 2B
R830-KV-3A	DN500 (20")	RAS 3 - HPO Reactor 3A
R835-KV-3B	DN500 (20")	RAS 3 - HPO Reactor 3B
KV-101 (*)	DN250 (10")	WAS 1 Header
KV-102 (*)	DN250 (10")	WAS 2 Header
KV-103 (*)	DN250 (10")	WAS 3 Header
(*) New WAS valve tags to be determined according to City Standards – tags shown are temporary placeholders.		

### 2.3 BALL VALVES

- .1 Service: low point drains and high point vents on RAS and WAS piping.
- .2 Ball valve, full port, 2 piece, NPT, 316 SS, RTFE seats, 1000 psi WOG at 200 F, blowout-proof stem, lockable lever handle.
- .3 Size: DN 50 (2") unless indicated otherwise on Drawings.
- .4 Acceptable Manufacturers: MA Stewart, FlowTek, Jamesbury, Triac or approved substitute in accordance with B8

## Part 3 Execution

### 3.1 EXAMINATION

- .1 Verification of Conditions: verify that conditions of substrate previously installed under other Sections or Contracts are acceptable for installation in accordance with manufacturer's written instructions.
  - .1 Visually inspect substrate.
  - .2 Inform Contract Administrator of unacceptable conditions immediately upon discovery.
  - .3 Proceed with installation only after unacceptable conditions have been remedied and after receipt of written approval to proceed from Contract Administrator.

### 3.2 INSTALLATION

- .1 Install each valve in accordance with manufacturer's recommendations.
- .2 The orientation of the new valve shall be identical to that of the original/replaced valve.
- .3 Chain wheels and shall be installed on valve handwheels in cases where handwheel is more than 2.0m above the operating floor or platform. Chain lengths to fall within 1m from floor or operating level. Contractor shall provide hooks to hold chains clear of operating areas. Chain wheels shall not be installed on threaded valves or valves DN50 (2") and smaller without Contract Administrator approval.
- .4 Valve handwheels shall be installed at the orientation indicated on the piping drawings. They shall not be installed with the stem below the horizontal position without Contract Administrator approval. Handwheels shall not obstruct operating aisles or walkways.

- .5 Low point drain and high point vent manual valves shall be provided with threaded plug in open end, plug material to match valve.
- .6 Valves are identified by the tag number as per piping specifications. Contractor shall continually monitor valve installation to ensure the correct valves are installed.

### **3.3 COMMISSIONING**

- .1 As part of commissioning activities, develop schedule of valves and record thereon identifier, location, service, purchase order number and date, manufacturer, identification data specified above.
- .2 All new manual and control valves to be operationally tested in accordance with the Commissioning Plan.

### **3.4 CLEANING**

- .1 Progress Cleaning: clean in accordance with Manufacturer's recommendations.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

### **3.5 PROTECTION**

- .1 Protect installed products and components from damage during construction.
- .2 Repair damage to adjacent materials caused by valve installation.

**END OF SECTION**

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## **Part 1            General**

### **1.1                SCOPE OF WORK**

- .1        The scope of Work includes all items identified on the drawings and the specifications. The following list of major Work items has been provided to provide a high-level overview.
- .2        Adjustment, modification, and relocation of existing electrical equipment, wiring, raceway, and cable tray within 100mm working space around Return Activated Sludge (RAS) and Waste Activated Sludge (WAS) piping and as indicated on the drawings to allow for pipe replacement and refurbishment.
- .3        Disconnection and removal of existing RAS and WAS flowmeters as indicated on the drawings.
- .4        Supply and installation of new RAS and WAS flowmeters as indicated on the drawings and datasheets.
- .5        Provision of temporary lighting in areas where existing lighting is obstructed by scaffolding and other construction equipment. Existing lighting levels shall be maintained to permit continuation of City operations activities.
- .6        Provision of temporary lighting and power for construction.

### **1.2                RELATED SECTIONS**

- .1        This Section covers items common to Sections Division 26, Electrical.

### **1.3                REFERENCES**

- .1        Canadian Standards Association (CSA International)
  - .1        CSA C22.1-06, Canadian Electrical Code, Part 1, Safety Standard for Electrical Installations.
  - .2        CAN3-C235, Preferred Voltage Levels for AC Systems, 0 to 50,000 V.
- .2        Electrical and Electronic Manufacturer's Association of Canada (EEMAC)
  - .1        EEMAC 2Y-1-1958, Light Gray Colour for Indoor Switch Gear.
- .3        Institute of Electrical and Electronics (IEEE)/National Electrical Safety Code Product Line (NESC)
  - .1        IEEE SP1122-2000, The Authoritative Dictionary of IEEE Standards Terms, 7th Edition.

### **1.4                DEFINITIONS**

- .1        Electrical and electronic terms: unless otherwise specified or indicated, terms used in these specifications, and on drawings, are those defined by IEEE SP1122.

### **1.5                DESIGN REQUIREMENTS**

- .1        Operating voltages: to CAN3-C235.
  - .2        Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits established by above standard.
-

**Part 1 General**

**1.1 SUMMARY**

- .1 This Section Includes
  - .1 Requirements for rehabilitation of the three carbon steel Return Activate Sludge (RAS) train piping systems and a carbon steel Waste Activated Sludge (WAS) pipe header located in the Secondary Clarifier Building at the NEWPCC wastewater treatment plant in Winnipeg, MB, using an externally applied Carbon Fiber Reinforced Plastic (CFRP) Repair System that must provide full structural integrity without reliance on the original piping (i.e. “Standalone”).
  - .2 The extents and sequencing of composite wrap repairs for localised, or priority repair locations, and for the system-wide rehabilitation planned for each RAS train.
  - .3 Requirements for the mock-up test spools for use in proof testing the wrap system prior to installation.
- .2 Scope of Work
  - .1 Design, manufacture, and installation of a CFRP Repair System to the following:
    - .1 Approximately 500m of RAS piping in the RAS gallery ranging in size from DN300 to DN900, including end terminations, supports, valves, mechanical couplings, flanges, and other appurtenances. Refer to the drawing set and 3D model provided for details of the extents of the repair required.
    - .2 Approximately 15m of WAS piping in the RAS gallery, consisting of the common discharge header from the four WAS pumps, including end terminations, supports, flanges, and other appurtenances. Refer to the drawing set and 3D model provided for details of the extents of the repair required.
  - .2 Complete engineering design of the CFRP Repair System approved by a qualified Professional Engineer who is registered in the province of Manitoba.
  - .3 CFRP wrap materials selection, manufacture, procurement, storage, and delivery by the CFRP Manufacturer of the wrap system.
  - .4 Installation of the CFRP Repair System including:
    - .1 Cleaning and surface preparation of the existing pipeline segments, and installation of the bonded composite as described in this section and the referenced contract Drawings.
    - .2 All scope listed herein including wastewater mitigation, mixing of epoxies, saturation of reinforcing fabrics, installation of the composite system, supply of QA/QC representative from the CFRP Design Engineer for the duration of the project, and installation of end joint details shall be self-performed by the CFRP Installer, meeting the experience requirements outlined in this specification.
    - .3 The CFRP Installer will provide mitigation of any leaked/discharged RAS fluid, if there are any holes or leaks in the pipe prior to installation.
    - .4 Cure all installed CFRP as required.
    - .5 Completion of all Work within the construction window as defined by the Construction Schedule contained in the Bid Opportunity.
    - .6 Coordination of the repair with the replacement of the existing pipe supports with new pipe supports.

## 1.2 RELATED SECTIONS & DRAWINGS

- .1 Section 01 33 00 – Submittal Procedures.
- .2 Section 01 78 00 - Closeout Submittals
- .3 Section 05 12 23 Structural Steel
- .4 Section 02 83 10 Lead Abatement
- .5 Section 23 05 00 General - Mechanical
- .6 Section 23 05 05 Piping
- .7 Section 23 05 23.03 Valves
- .8 Contract Drawings and 3D Model:
  - .1 Refer to item E1.4

## 1.3 REFERENCE STANDARDS

- .1 American Society of Mechanical Engineers (ASME):
    - .1 ASME PCC-2-2018 Part 4, Article 4.1 - Non-Metallic Composite Repair Systems for Pipelines and Pipework: High-Risk Applications
    - .2 ASME PCC-2-2018 Part 2, Article 2.10 – In-Service Welding Onto Carbon Steel Pressure Components or Pipelines
  - .2 American Society for Testing and Materials
    - .1 ASTM D3039 / D3039M – 17 Standard Test Method for Tensile Properties of Polymer Matrix Composite Materials
    - .2 ASTM D5379 / D5379M – 19 Standard Test Method for Shear Properties of Composite Materials by the V-Notched Beam Method
    - .3 ASTM D2583 – 13 Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor
    - .4 ASTM D2240 – 15 Standard Test Method for Rubber Property—Durometer Hardness
    - .5 ASTM E831 – 19 Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermomechanical Analysis
    - .6 ASTM E1640 - 18 Standard Test Method for Assignment of the Glass Transition Temperature By Dynamic Mechanical Analysis
    - .7 ASTM D648 - 18 Standard Test Method for Deflection Temperature of Plastics Under Flexural Load in the Edgewise Position
    - .8 ASTM D3165 - 07(2014) Standard Test Method for Strength Properties of Adhesives in Shear by Tension Loading of Single-Lap-Joint Laminated Assemblies
    - .9 ASTM D5868 - 01(2014) Standard Test Method for Lap Shear Adhesion for Fiber Reinforced Plastic (CFRP) Bonding
    - .10 ASTM D2990-17 Standard Test Methods for Tensile, Compressive, and Flexural Creep and Creep-Rupture of Plastics
    - .11 ASTM D2992-01 Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe and Fittings
-

- .12 ASTM G8 - 96(2019) Standard Test Methods for Cathodic Disbonding of Pipeline Coatings
- .13 ASTM G95-07 Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method)
- .14 ASTM D695 - 15 Standard Test Method for Compressive Properties of Rigid Plastics
- .15 ASTM D6641/D6641M-01 Standard Test Method for Determining the Compressive Properties of Polymer Matrix Composite Laminates Using a Combined Loading Compression (CLC) Test Fixture

#### 1.4 DEFINITIONS

- .1 CFRP Repair System: An externally applied piping repair system defined as the combination of the following elements for which qualification testing has been completed:
    - .1 Substrate
    - .2 Surface preparation
    - .3 Composite material (CFRP repair laminates)
    - .4 Filler material
    - .5 Adhesive
    - .6 Application method
    - .7 Curing protocol
  - .2 Carbon Fiber Reinforced Polymer (CFRP): A solid composite material that is comprised of a thermoset resin system that is reinforced by continuous high-strength carbon fiber fabric.
  - .3 Glass Fiber Reinforced Polymer (GFRP): A solid composite material that is comprised of a thermoset resin system that is reinforced by continuous glass fiber fabric, used as an insulator between the steel pipe and CFRP to prevent possible galvanic action.
  - .4 CFRP Manufacturer: The company or organisation that develops and manufactures the materials that comprise the CFRP Repair System.
  - .5 CFRP Design Engineer: The company or individual that is responsible for the design of the CFRP Repair System that is based on this technical specification and contract Drawings provided by the Contract Administrator. The CFRP Design Engineer is the Engineer of Record for the CFRP Repair System.
  - .6 CFRP Inspector: The company or individual responsible for the continuous on-site inspection of the CFRP Repair System as a representative of the CFRP Design Engineer.
  - .7 CFRP Installer: The company or organisation that installs the CFRP Repair System using the materials supplied by the CFRP Manufacturer and the drawings and specifications provided by the CFRP Design Engineer and the Contract Administrator.
  - .8 Stand Alone Repair System: A CFRP Repair System that fully replaces the pipe that previously contained the process fluid. The standalone system must generally be able to support the process fluid and existing pipe on its own and remain within design limits for stress and strain.
-

## 1.5 QUALIFICATION REQUIREMENTS

- .1 CFRP Manufacturer:
  - .1 Shall have completed a minimum of five (5) projects involving external CFRP systems for above-grade piping rehabilitation within the past five (5) years, where the same system proposed for use on this project has been used as a stand-alone repair of the pipeline without reliance on the host pipe for structural integrity. For a reference project to be considered applicable, it must include all of the following:
    - .1 Repair on piping system greater than or equal to 300mm diameter, containing fittings, branch connections, flanges or couplings, with design pressures greater than 345 kPag;
    - .2 Pipeline repair minimum length of 6m;
    - .3 Located in the United States or Canada; and
    - .4 A verifiable reference contact from project owner.
  - .2 Shall have completed a minimum of 500m of external CFRP systems for above-grade piping rehabilitation within the past five (5) years, using the same CFRP system proposed for use on this project, with a minimum of 200m total length on a single project.
- .2 CFRP Design Engineer:
  - .1 Shall be approved by the CFRP Manufacturer as Design Engineer for the same system proposed for use on this project. This will be documented in writing by the CFRP Manufacturer and accepted by the Contract Administrator prior to starting the work.
  - .2 Shall be employed by a company that is independent from the CFRP Manufacturer and CFRP Installer.
  - .3 Shall be a Professional Engineer licensed and registered in Manitoba.
  - .4 Shall have completed design for a minimum of five (5) external pipe CFRP systems within the past five (5) years. Provide detailed project summary and project owner's contact information for all reference projects.
- .3 CFRP Inspector:
  - .1 Shall be a representative of the same company as the CFRP Design Engineer to provide continuous field support and inspection throughout the CFRP system construction process.
  - .2 Shall have completed inspection for a minimum of five (5) pipe external CFRP systems in the past five (5) years. Provide detailed project summary and project owner's contact information for all reference projects.
- .4 CFRP Installer:
  - .1 Shall be approved by the CFRP Manufacturer as Installer for the same system proposed for use on this project. This will be documented in writing by the CFRP Manufacturer and accepted by the Contract Administrator prior to starting the work.
  - .2 Shall have completed a minimum of five (5) projects involving external CFRP systems for above-grade piping rehabilitation within the past five (5) years, where the same system proposed for use on this project has been used as a stand-alone repair of the pipeline without reliance on the host pipe for structural integrity, For a reference project to be considered applicable, it must include all of the following:

- .1 Repair on piping system greater than or equal to 300mm diameter, containing fittings, branch connections, flanges or couplings, with design pressures greater than 345 kPag;
  - .2 Pipeline repair minimum length of 6m;
  - .3 Located in the United States or Canada; and
  - .4 A verifiable reference contact from project owner.
- .3 Shall have completed a minimum of 500m of external CFRP systems for above-grade piping rehabilitation within the past five (5) years, using the same CFRP system proposed for use on this project, with a minimum of 200m total length on a single project.
  - .4 Shall have current training records documenting that all supervisors and installation technicians who will be performing the Work are trained and licensed/certified by the CFRP Manufacturer for the proposed repair system in accordance with ASME PCC-2 Part 4, Article 4.1, Mandatory Appendix VII,
  - .5 Shall certify that the foreman, supervisors and top three (3) installation technicians who will be performing the Work each have a minimum of three (3) years of experience on minimum of five (5) projects for above-grade piping rehabilitation using the same CFRP system proposed for use on this project. A list of names, titles and projects shall be provided.

## 1.6

### SUBMITTALS

- .1 The design drawings listed below are to be submitted to the Contract Administrator in accordance with Section 01 33 00 - Submittal Procedures and stamped and signed by professional engineer registered or licensed in Manitoba, Canada. The design drawings shall be submitted for approval by the Contract Administrator prior to commencing Work.
    - .1 Details of the proposed repair system as intended for each pipe diameter including a standard tapered termination, joints between sections of wrap, and galvanic isolation and/or cathodic protection for each.
    - .2 Details of proposed methods for terminating at flanges.
    - .3 Detail of connections to concrete and welded pipe supports.
    - .4 Detail of enclosure of dresser-type couplings including integrated expansion joint and tie-rods.
    - .5 Detail of enclosure of valves including adhesion zone below bolted bonnet.
    - .6 Details for small and large diameter fabricated tees, reducers, and elbows (mitered bends), and branch connections.
    - .7 Details for high-point vent and low-point drain connections.
    - .8 Details of any specialty prefabricated half-cylinder shell type sections for use on valves, flanges, and fittings.
    - .9 Detail of expansion joints, if applicable.
    - .10 Details for repair of existing leak locations.
    - .11 Special details and/or procedures require to apply the CFRP near obstructing/close proximity items.
  - .2 The following design specifications shall be submitted in accordance with Section 01 33 00 - Submittal Procedures for approval by the Contract Administrator for approval prior to commencing Work:
    - .1 Type of composite wrap repair system.
    - .2 Product name of primer layer adhesive.
-

- .3 Product name of reinforcing fabric(s), composite material or repair laminate.
  - .4 Product name of load transfer material or saturating epoxy.
  - .5 Product name of top-coat and smoke development/flame spread rating.
  - .6 Product name of any other adhesives or solvents used.
  - .7 Weight of fabric, number of layers and orientation.
  - .8 Minimum overlap circumferentially and longitudinally.
  - .9 Installation procedure, including curing protocol and surface preparation.
  - .10 Repair procedures and details for damaged fabric layers.
  - .11 List of equipment to be used for surface prep and to apply and cure the composite wrap.
- .3 The following design documentation shall be submitted in accordance with Section 01 33 00 - Submittal Procedures for approval by the Contract Administrator for approval prior to commencing Work:
- .1 A completed copy of the component repair datasheet contained in ASME PCC-2 Part 4, Article 4.1, Mandatory Appendix I for the RAS piping and WAS piping.
  - .2 Full set of ASME PCC-2 calculations associated with each of the design details as outlined in Part 3 of this specification.
  - .3 List of the composite material properties including variable name and value used in the design calculations. These must be the same as provided in the qualification data. Any variation shall be clearly identified for review.
- .4 Other submittals:
- .1 Certificates signed by the CFRP Manufacturer certifying that materials comply with specified performance characteristics and physical properties.
  - .2 CFRP Manufacturer's written installation procedures, maintenance instructions, and general recommendations regarding the overall system and each material to be used.
  - .3 Workplace Hazardous Materials Information System (WHMIS) Material Safety Data Sheets (MSDS).
  - .4 Procedure for fabrication of the mock-up pressure test spools as shown on the drawings.
  - .5 One complete assembly of the proposed combination of primer, wrap, adhesives, and top-coat. Mount sample on 12 mm plywood board. Affix label beneath sample indicating laminate details.
  - .6 Application instructions, delivery, storage and handling instructions, and general recommendations regarding each material to be used.
  - .7 Each step of the application method with surface preparation, application, cure, and seal of the proposed combination of primer adhesive, repair laminate, filler, and top-coat.
  - .8 Basic material documentation required in subsection 3.2.1 of ASME PCC-2 Part 4, Article 4.1 clearly indicating the product name and manufacturer, accompanied by the applicable datasheet highlighting each parameter required.
  - .9 Weld Procedure Qualification Records and Welder Performance Qualification Records for all in-service welding onto carbon steel piping components, in accordance with ASME PCC-2 Part 2, Article 2.10.
-

## **1.7 CLOSEOUT SUBMITTALS**

- .1 Provide maintenance data for incorporation into manual specified in Section 01 78 00 - Closeout Submittals.
- .2 Signed and completed Inspection Test Plan documents for each RAS train.
- .3 Visual inspection reports for each RAS train in accordance with the quality control requirements of this specification.
- .4 Letter of certification from the CFRP Design Engineer certifying that the wrap system was:
  - .1 Visually inspected in accordance with the quality control requirements of this specification and is defect free, and
  - .2 Installed in accordance with the design drawings, specifications, and calculations.
- .5 Completed City of Winnipeg Forms 100, 101, 102, 103, and 104 (refer to Quality Control and Commissioning sections of this document for further details).

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- .1 Packing, shipping, handling and unloading:
    - .1 The products shall be delivered in original, unopened containers. Containers shall be clearly marked with legible and intact labels listing the product manufacturer's name, brand name, product identification, batch number, storage conditions, mixing ratios, and shelf-life.
    - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
    - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
      - .1 Storage and Protection:
      - .2 Protect from weather, construction traffic.
      - .3 Protect against damage.
      - .4 Store at temperatures and conditions required by manufacturer.
  - .2 Storage
    - .1 Storage of all materials and equipment on site shall be in designated storage areas agreed upon with the City and using pre-authorized access/egress for movement of materials.
    - .2 Store materials in areas where temperatures conform to the product manufacturer's written recommendations and instructions and WHMIS 2015 requirements.
    - .3 Stored fiber reinforcement and resins shall be protected from dust, moisture, and chemical exposure.
    - .4 Fabric boxes should not be stored on end, be in contact with moisture or left open in direct sunlight.
    - .5 Resin components shall be stored separately and in tightly closed containers, away from direct sunlight, flame sources, or other hazards.
    - .6 Fiber reinforcement and resins shall not be exposed to freezing temperatures during transport, storage, preparation, installation or curing.
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- .7 Inspect and certify that all required materials are available, identified by lot numbers, correctly labeled and have not reached their shelf life or use expiration date.
- .3 Handling
  - .1 The fabric reinforcement shall not be handled roughly. Care shall be taken not to damage the fibers.
  - .2 Fabric reinforcement may be stored either in rolls of 4 in. radius or greater or stacked after cutting.
  - .3 Consult the product manufacturer's MSDS for specific handling hazards of resin components.
- .4 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling or reuse.
  - .2 Place excess or unused composite wrap accessory materials in designated containers.
  - .3 Divert unused metal materials from landfill to metal recycling facility.
  - .4 Dispose of unused adhesive material at an official hazardous material collections site approved by Contract Administrator.

## **Part 2 Products**

### **2.1 GENERAL**

- .1 All components of the composite system including primer, epoxy, fiber reinforcement, impregnating resin, and topcoat resin shall be compatible and provided by the same manufacturer.
- .2 Products used shall be the same as those listed in the material qualification data submitted to the Contract Administrator for review prior to award of the bid. Any substitutions shall require approval by the Contract Administrator prior to use and shall be in accordance with Section B8 "Substitutes".

### **2.2 CFRP REPAIR SYSTEM**

- .1 The CFRP Repair System shall consist of epoxy primer, thickened epoxy (i.e., putty), unidirectional carbon fabric, impregnating epoxy resin, and topcoat. Other resin types (e.g., polyester, vinyl ester) shall not be used as any of these components.
  - .2 Primer
    - .1 The steel substrate shall be primed with an epoxy material, which shall penetrate the pore structure of the substrate. The primer shall be 100% solids, low viscosity epoxy resin.
    - .2 The primer shall have following minimum properties obtained according to ASTM D638 at 22°C and 40% relative humidity:
      - .1 Tensile strength: 17 MPa (2,500 psi), minimum
      - .2 Tensile modulus: 724 MPa (105 ksi), minimum
  - .3 Thickened Epoxy
    - .1 Thickened epoxy shall have a high enough viscosity to fill all voids in the steel substrate and provide a smooth base for the subsequent CFRP laminates.
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- .2 Thickened epoxy shall either be pre-formulated and brought to site in pre-proportioned containers or prepared on site by mixing the impregnating resin with Cab-O-Sil TS-720 treated fumed silica to achieve the required viscosity.
- .4 Impregnating Resin
  - .1 All fabrics shall be impregnated with 100% solids, low viscosity epoxy resin.
  - .2 The CFRP repair design shall use a two-component epoxy with the following mechanical properties obtained according to ASTM D638 at 22°C and 40% relative humidity and reported by the Manufacturer:
  - .3 Maximum water absorption when tested in accordance with ASTM D570 (24 hours): 2 percent
  - .4 Minimum compressive yield strength of 69 MPa (10,000 psi) when tested in accordance with ASTM D695 (24°C, 7-day cure);
  - .5 Minimum tensile strength with an elongation of greater than 2 percent when tested in accordance with ASTM D638 (14-day cure): 41 MPa (6,000 psi)
  - .6 Tensile modulus: 2,068 MPa (300 ksi)
  - .7 Minimum flexural strength when tested in accordance with ASTM D790 (14-day cure): 52 MPa (7,500 psi)
- .5 Carbon Fiber-Epoxy Laminates
  - .1 The CFRP rehabilitation design shall use carbon fiber composite laminates with the following mechanical and physical properties:
  - .2 The tensile properties of the CFRP lamina shall be determined according to ASTM D3039 and statistically analyzed according to ASTM D7290 to determine the characteristic values.
  - .3 Minimum tensile modulus of elasticity (ASTM D7290): 62,053 MPa (9,000 ksi)
  - .4 Minimum laminate thickness: 1.8mm (0.07 inch)
  - .5 Maximum laminate thickness: 2.5mm (0.10 inch)
  - .6 Minimum tensile strength (ASTM D7290): 689 MPa (100 ksi);
  - .7 Minimum flexural modulus of 2413 MPa (350,000 psi)
  - .8 Minimum flexural strength of 97 MPa (14,000 psi)
  - .9 Minimum strain at CFRP rupture, when tested in accordance with ASTM D3039: 0.85 percent (obtained as the ratio of characteristic tensile strength and Weibull mean of the modulus)

## **2.3 GFRP SYSTEM**

- .1 A glass fiber reinforced polymer (GFRP) composite system shall be used as insulator between the steel pipe and the CFRP to avoid possible galvanic corrosion and also shall be used as a watertightness layer.
  - .2 The GFRP composite system shall be a proprietary system consisting of all associated fiber reinforcement and polymer adhesives/resins. All components of the GFRP composite system shall be provided by the same Manufacturer of CFRP system. The GFRP composite laminates shall have the following mechanical and physical properties:
    - .1 Minimum tensile modulus of elasticity: 13,790 Pa (2,000 ksi)
    - .2 Minimum laminate thickness: 0.8mm (0.03 inch)
    - .3 Maximum laminate thickness: 2.5mm (0.10 inch)
    - .4 Minimum tensile strength: 207 MPa (30 ksi)
    - .5 Minimum strain at GFRP rupture (ASTM D3039): 1.0 percent
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- .3 The total nominal thickness of a single GFRP laminate shall not be less than 0.8mm (0.03 in).

## **2.4 CFRP SYSTEM FLAME AND SMOKE RATED COATING**

- .1 The flame and smoke rated coating to be applied to the CFRP system shall be in accordance with CAN/ULC-S102. The product maximum Flame Spread Value (FSV) of 25 and maximum Smoke Developed Value (SDV) of 50.
- .2 Refer to Appendix R for approved colour standard for RAS and WAS piping.

## **2.5 FLANGE TERMINATION SLEEVES**

- .1 Flange termination sleeves shall be provided at existing slip-on flanges to provide a substrate for bonding of the CFRP end terminations, as shown on the contract Drawings. These sleeves are considered an integral part of the CFRP Repair System.
- .2 Flange termination sleeves shall be constructed from carbon steel pipe, STD wall, A53-B, or formed carbon steel plate, A36, as shown on contract Drawings.

## **2.6 MANUFACTURER**

- .1 The following CFRP Manufacturers are approved for this project:
  - .1 Structural Technologies, 10150 Old Columbia Road, Columbia MD 21046, or approved substitute in accordance with B8. Contact Dave Caughlin: (301) 310-5060.

## **2.7 APPROVED MATERIALS**

- .1 CFRP Repair System: Structural Technologies V-Wrap Carbon Fiber System or approved substitute in accordance with B8.

## **Part 3 Execution**

### **3.1 GENERAL**

- .1 Construction
  - .1 Design, Mock-Up Spool Testing, Installation and Commissioning shall follow the requirements of the Construction Plan in Appendix D and the Commissioning Plan in Appendix E.

### **3.2 DESIGN REQUIREMENTS**

- .1 Design Approach
    - .1 Design the composite repair system as a Stand-Alone above-grade pipe (i.e., carrying 100% of the internal and external loads acting on the pipe). No contribution from the host pipe shall be considered.
    - .2 Take into consideration the specific forces and stresses acting on the composite wrap due to the arrangement of piping, pipe supports, and fittings on each RAS train. This includes stress concentration factors for elbow and tee fittings, and support type and spacing.
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- .3 Account for special considerations produced by the presence of dresser-type couplings, pipe supports, flanges, small and large branch connections, and any other fittings or appurtenances that may be connected to the pipe.
  - .4 The contract Drawings and specifications provided by the Contract Administrator are provided for definition of scope only. They do not absolve the CFRP Design Engineer of any responsibility of the design of the repair system. In the event the CFRP Design Engineer may not certify the integrity of the design due to the requirements shown on the contract Drawings and specifications, the Contract Administrator shall be notified, and the design issue resolved.
- .2 Design Criteria
- .1 The design shall be in strict accordance with ASME PCC-2 Part 4, Article 4.1 Nonmetallic Composite Repair Systems: High Risk Applications. The "Type B Design Case" shall be used. No modifications to this standard are allowed in design, calculations, or Drawings, or other design documentation.
    - .1 The repair system design method shall be in accordance with ASME PCC-2 Part 4, Article 4.1 subsection 3.4.6 for Leaking Components.
    - .2 The method for determining the toughness parameter (energy release rate) shall be in accordance with Appendix IV. If this test has been performed previously for the repair system, then those results may be used.
  - .2 The repair system design calculations shall account for the following mechanical failure modes:
    - .1 Rupture of laminate in the circumferential direction due to internal pressure.
    - .2 Rupture of laminate in the circumferential direction from bending due to gravity.
    - .3 Rupture of laminate in the circumferential direction due to combined pressure and bending due to gravity loads including those applied by connecting pipework.
    - .4 Buckling of the laminate in the circumferential direction due to gravity and any other external loads.
    - .5 Rupture of the laminate in the longitudinal direction due to pressure induced thrust, Poisson's effect of internal pressure, and temperature change.
    - .6 Interlaminar shear failure at wrap terminations and overlapping sections of wrap.
    - .7 Buckling of the laminate in the longitudinal direction due to temperature change.
  - .3 The additional weight of the wrap itself, and the layout of the new supports shall be accounted/verified for in the design. If additional, temporary, or modified supports are required to maintain acceptable stress and strain in the composite, the Contract Administrator shall be notified.
  - .4 The design of the composite wrap shall employ the same products and their physical properties as provided in the repair system qualification data given prior to award. If any changes or variation become evident, the CFRP Design Engineer shall notify the Contract Administrator, and update all of the applicable submittal documents to reflect that change.
    - .1 The design shall include factors of safety that are selected for long-term and short-term loads, based on established procedures.
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- .5 The repair system shall be 100% leak free at the terminations and through-out the extents of the wrap.
  - .6 The nominal layer thickness shall be determined using the thickness of the test coupons tested for the qualification data in Appendix J divided by the number of layers used in preparing the coupons. See ASME PCC-2 Part 4, Article 4.1, Table 1 and subsection 3.4.11. Calculations shall use the nominal thickness of any layers of CFRP. Material properties of any GCFRP materials or intermediate layers of thickened epoxy shall be excluded from the design.
  - .7 The composite wrap repair shall be designed using the information provided in the Contract Drawings and the process data provided in Appendix K.
  - .8 The minimum required design life of the repair system is 25 years.
  - .9 The design calculations shall use the nominal thickness of any layers of the composite wrap. Material properties of any galvanic insulating materials or intermediate layers of thickened epoxy shall be excluded from the design.
  - .10 External loading and cyclical loading are not applicable.
  - .11 The properties listed on the product data sheets for the materials used shall be equal to or better than the properties used in the design calculations.
  - .12 The design requirements utilized in the design calculations shall be equal to or greater than the design requirements in this specification.
- .3 Flange Termination Sleeves
- .1 The composite wrap shall be terminated with end details that prevent wastewater from leaking from the space between the inside of the composite wrap and the pipe exterior.
  - .2 Composite wrap shall terminate at flanges in a manner that will permit flange unbolting/bolting without damaging wrap
  - .3 Flanges shall be fitted with a welded sleeve to permit adhesion of the composite wrap end terminations, as shown on the contract Drawings. If such a sleeve cannot be fitted due to the piping arrangement or condition, the Contractor shall propose an alternate solution for adhesion of the CFRP wrap end termination, for Contract Administrator approval.
- .4 In-Service Welding
- .1 Welding onto existing pipe and pressure components (e.g., flanges) while the system is in operation shall consider the requirements and precautions outlined in ASME PCC-2, Article 2.10, including the following:
    - .1 Welding procedures and welders shall be qualified using the setup detailed in Mandatory Appendix I and testing requirements outlined in paragraph 4.2.
    - .2 All in-service welds made in the field shall be examined for hydrogen cracking after welding by magnetic particle or liquid penetrant methods in accordance with ASME B31.3, paragraphs 344.3 or 344.4. Welds shall be examined 24 hr to 72 hr after welding has been completed.
- .5 Fittings and Supports
- .1 Stress concentrations factors shall be used to account for high stress locations on the composite wrap that may occur as a result of the presence of elbows, tees, reducers, fabricated tees and reducers, mitered bends, dresser couplings, supports, and branch connections.
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- .6 Dresser-Type Couplings
    - .1 Dresser-type couplings and associated tie-rod assemblies shall be fully enclosed by the composite wrap.
  - .7 Expansion Joints
    - .1 If required, the composite wrap shall be fitted with expansion joints at key locations to accommodate differential movement between the host piping and CFRP Repair System after installation due to thermal or other effects during operation.
  - .8 Column and Bracket Supports
    - .1 Composite wrap shall be applied up to the limit of the column or bracket support, followed by the installation of a new support, and the removal of the existing support. The remainder of the wrap shall be installed after the existing support is removed. The design calculations shall account for the joints made at each existing support location.
  - .9 Concrete Saddle Supports
    - .1 The concrete saddle supports shall be partially enclosed by the repair system, with the composite wrap extending down the saddle, and with an adhesive leak-proof bond made between the concrete saddle and the repair system.
  - .10 Welded-on Elbow Supports and Other Appurtenances
    - .1 Any welded appurtenances such as existing low-point drains and high-point vents shall be fully encapsulated.
  - .11 Manual Isolation Valves
    - .1 Unless otherwise noted on the contract Drawings, end terminations shall be made on either side of each valve, and the valve itself is not wrapped. Operation and maintenance access to the valve and connecting flanges remains unaffected by the new wrap.
    - .2 In specific locations noted on the contract Drawings, valves will be totally encapsulated due to insufficient space for an end termination. In these instances, the valve will be encapsulated, leaving only the bolted bonnet and the operating wheel exposed to permit continued operation and in-line maintenance of the manual isolation valve.
  - .12 Locations of Close Proximity
    - .1 A list of locations where the RAS train piping is in close proximity to existing structure or mechanical/electrical services is included in the 3D model and as a list document in Appendix L. The Contractor will develop a plan to temporarily relocate or otherwise address all close proximity items as required to install the CFRP Repair System.
  - .13 Existing Leaks
    - .1 A list of locations where existing leaks have started is included in the model and as a list document in Appendix M. A leak specific repair shall be made to each location prior to the application of the composite wrap to the complete system. Upon repair to the extents of the system, the leak repair locations shall be fully encapsulated.
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### 3.3 MOCK-UP TESTING

- .1 The CFRP Installer shall fabricate three mock-up test spools as shown on the drawings and perform a minimum of one pressure test each.
- .2 The mock-up spool design, fabrication, and testing shall:
  - .1 Employ the proposed repair system used in the design.
  - .2 Contain at least three defects as shown on the drawings.
  - .3 Be fabricated from ASTM A106 Grade B carbon steel piping.
  - .4 Be tested at a pressure of 620 kPa (90 psi) for four hours.
- .3 Shop drawings shall be submitted by the CFRP Installer to the Contract Administrator that contains the fabrication details of the spools to be tested including the size and location of test defects.
- .4 A testing report demonstrating water tightness of the proposed system shall be provided. The testing report shall demonstrate that the proposed layup does not leak when subjected to the test pressure for the time-period specified.
- .5 The test report shall contain complete details of the composite wrap repair including:
  - .1 Products used
  - .2 Surface preparation
  - .3 Thickness, type, and number of each layer
  - .4 Cure time
  - .5 Pipe material
- .6 If the testing yields results that lead to changes in the wrap installation products, installation method, or design the documentation provided in the bid shall be revised to reflect these changes and resubmitted to the Contract Administrator for review.
- .7 One pull test shall be performed to verify the adhesion between the carbon steel substrate pipe (ASTM A106-B) and the composite pipe wrap repair material. The adhesion pull test shall be in accordance with ASTM D4541.

### 3.4 INSTALLATION

- .1 General
    - .1 The installation shall comply with the requirements of ASME PCC-2 Part 4, Article 4.1, and all product data, manufacturers documentation, and reference standards. In the event that these documents are found to contradict each other, ASME PCC-2 Part 4, Article 4.1 shall be used as the governing document and the Contract Administrator shall be notified in writing.
    - .2 The installation procedure shall be the same as the proposed procedure submitted with the pre-award documentation and used in the qualification tests of the mock-up test spools. If the installation procedure deviates from either of these, a new procedure is to be submitted for review and approval by the Contract Administrator prior to implementation.
    - .3 The CFRP Installer shall furnish all tools, equipment, materials and supplies and shall perform all labor required to complete installation of the fiber reinforced polymer (CFRP) renewal process in full conformity with the Contract Documents
    - .4 All sharp edges and corners are rounded to a minimum ½ inch radius. This can also be accomplished by thickened epoxy resin build-up.
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- .5 Any joint gaps or deep imperfections must be properly filled with approved joint filler and rendered smooth.
  - .6 Required repairs or patchwork shall be completed and cured prior to application of primer or epoxy materials.
  - .7 The locations of all lateral connections to the host pipe shall be noted and suitable preparation made to ensure the CFRP connects into the lateral connections.
  - .8 All components shall be evenly and completely mixed at the proper ratios specified.
  - .9 Surfaces shall be properly primed in accordance with the manufactures instructions.
  - .10 Batch numbers and/or lot numbers will be recorded each day for polymer wrap materials that are used.
  - .11 The specific localized areas where a leak is already present shall be subject to repair ahead of the application of the system wide composite wrap repair. These locations are shown on the contract Drawings and 3D model. Refer to the Construction Plan document in Appendix D for the proposed repair schedule.
- .2 Safety
- .1 Refer to 23 05 00 General – Mechanical for safety requirements.
  - .2 Lead abatement shall be in accordance with Section 02 83 10
  - .3 Materials may be skin irritants or sensitizers. Accordingly, advise all site personnel to avoid contact with eyes and skin, inhalation of vapors, and ingestion. Use protective and safety equipment on site. Heed all label warnings by manufacturers. Application to be in accordance with applicable safety laws.
- .3 Pre-Install Inspection
- .1 Positively mark each pipe requiring rehabilitation and verify with the Contract Administrator prior to starting Work.
  - .2 Examine the existing conditions to assess quality of substrate, document any damaged condition, ovality, or surface irregularities in the pipe, and identify any leaks near repair areas. The CFRP Installer shall be responsible to provide a substrate that is sound, visibly dry and free of moisture.
  - .3 Examine the conditions under which materials will be stored, mixed, and transported to the pipe and specify corrective actions as necessary.
  - .4 Correct all unsatisfactory conditions and obtain the Contract Administrator approval prior to commencement of repairs.
- .4 Preparation
- .1 Environmental Conditions
    - .1 It shall be the Contractor's responsibility to control ambient conditions within the piping gallery via protective enclosures, heating/ventilation and/or dehumidification apparatus during surface preparation, application, and curing, to meet the specified conditions or conditions recommended by the CFRP Manufacturer for application and curing of the specified materials
    - .2 Temperature and humidity controls will be established in accordance with instruction from the CFRP Design Engineer. These conditions will be documented and verified at the specified frequency and recorded.
    - .3 Do not install the composite wrap when the ambient temperature and/or the relative humidity is outside the range required by the CFRP
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Manufacturer, and the pipe surface temperature is less than 2°C above the dewpoint. In cold conditions, auxiliary heat may be applied to raise the ambient temperature to a suitable level. If heating is used, direct-fired gas or kerosene "salamander" type heaters shall not be permitted. Only electric or indirect-fired heaters shall be permitted, to avoid contaminating the substrate with carbonation.

- .4 The presence of water inhibits the adhesion of epoxy to the substrate and may contribute to the formation of amine blush. Do not install composite wrap when surface moisture is present. Use dehumidifiers to keep the relative humidity within the range required by the CFRP Manufacturer.
- .5 If wastewater leakage exists through cracks, pinholes or welds, water flow shall be stopped by the CFRP Installer.
- .6 The Contractor shall provide all means necessary to exhaust harmful gases/fumes, dust and odors during execution of the work specified herein.

.5 Surface Preparation

- .1 Surface preparation shall be in accordance with ASME PCC-2 Part 4, Article 4.1 and the CFRP Manufacturers requirements for the proper adhesion of the repair system.
- .2 Mark the locations on the prepared surface to clearly define the installation positions or locations.
- .3 The coating on all three RAS trains is known to contain lead paint. See section above titled "Safety".
- .4 Prior to any grinding, blasting, or sanding for surface preparation of existing pipe or pipe fittings, the Contractor must perform Ultrasonic measurement of pipe wall thickness (UT), to verify that sufficient thickness exists in preparation area. Surface preparation shall not be performed in any area where pipe wall thickness is measured to be less than 6mm. In the event insufficient wall thickness is measured, the Contract Administrator shall be notified and the Contractor

.6 Curing

- .1 The CFRP Inspector shall check the cure process by performing hardness tests on the CFRP system based on the percent completion versus Barcol or Shore D hardness relationship provided by the manufacturer and inform the Contract Administrator of any nonconformance.

.7 Flame and Smoke Rated Finish

- .1 After the composite wrap is completed, the CAN/ULC-S102 flame and smoke rated finish shall be applied to the surface of the wrapped pipe. All exposed surfaces of the wrap assembly shall be coated to the thickness specified by the manufacturer to ensure the listed flame and smoke protection.

.8 Pipe Supports

- .1 Pipe supports shall be installed in accordance with Section 05 12 23 Structural Steel.
  - .2 The repair system shall be applied in the unsupported spans. Once these sections are completed, new supports will be located under the piping mid-span as shown in the 3D model and contract Drawings, and fully anchored. Once the new supports are fully installed, the original supports will be removed. The remaining open sections in the composite wrap will then be completed.
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- .9 Structure and Other items in Close Proximity
  - .1 The CFRP Installer shall take care to provide adequate measures to account for obstructions to the installation of the composite wrap on the piping where immovable objects such as structural members prevent the normal installation of the wrap. These locations shall be marked up on a copy of the contract Drawings with a description of the proposed solution and submitted to the Contract Administrator prior to commencement of Work.

### 3.5 QUALITY CONTROL

- .1 Installation of the repair system shall be in accordance with the Inspection and Test Plan document provided in Appendix N and also the Quality Control Checklist document provided in Appendix O.
  - .2 The repair system shall be visually inspected on a daily or continuous basis by the CFRP Inspector during construction. Recommendations by all parties will be provided directly to the Contract Administrator. The CFRP Installer shall take action to resolve any deficiencies observed when these are reported. The basis for the inspection criteria will be ASME PCC-2 Part 4, Article 4.1, Section 5 Examination. Prior to application of the seal coat, a visual inspection by the CFRP Inspector shall be performed to inspect for evidence of delamination or damaged wraps.
  - .3 The repair system shall be visually inspected by the CFRP Inspector after installation is complete in accordance with the requirements of ASME PCC-2 Part 4, Article 4.1, Section 5 Examination.
    - .1 An inspection report for each RAS train shall be provided by the CFRP Design Engineer upon completion of the installation of the repair system on each train.
    - .2 The visual inspection of each RAS train shall be repeated 2 years after Total Completion.
  - .4 Maintain an onsite and updated copy of the Quality Control Record Checklist for each section of wrap installed, not including gaps due to supports. Access to the QC Record shall be provided to the Contract Administrator to verify the documents are up to date and accurate.
  - .5 Field testing of the CFRP system is required each day of application. The CFRP Installer is responsible for carrying out all field tests required to demonstrate the adequacy of the design and the quality of the Applicator's workmanship.
  - .6 At a minimum, two sample panels shall be made for testing each day. The sample panels should measure at least 12"x12" by the required repair thickness using the same process as used for the repair installation. Each sample shall be coded and dated and shall be accompanied with the site environmental data, such as the pipeline temperature and humidity.
    - .1 The CFRP Installer will arrange for testing the tensile properties of 15% the samples at a certified laboratory in accordance with ASTM D 3039 and manufacturer's specifications. The testing shall be carried out no later than two weeks after the completed application of the composite wrap to the substrate and the results shall be supplied to the CFRP Design Engineer and the Contract Administrator within two weeks of laboratory testing.
    - .2 The tested tensile properties must exceed the design tensile strength as defined in the design. If one witness panel's average results do not achieve the design properties, additional coupons from the same day of application shall be tested. If
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the second panel fails to meet the required tensile properties, then the application of the CFRP system for that day shall be rejected. The CFRP Installer will be required to submit a method to repair the failed sections if this occurs. If the second panel is not required for immediate testing to verify properties, it shall be held by the CFRP Installer in a secure environment for a period of at least two years.

- .3 The testing shall provide values for each specimen as follows:
  - .1 Ultimate Tensile Strength
  - .2 Tensile Modulus and Related Specimen Thickness
  - .3 Percent Elongation
- .7 Pressure testing of the RAS piping after the repair system is installed is not required.
- .8 The CFRP Design Engineer will provide the services of a qualified representative to be physically present onsite to monitor the installation, start-up, commissioning, and performance testing (the CFRP Inspector). The services to be performed by the CFRP Inspector are as follows:
  - .1 The following City of Winnipeg standard forms must be signed by the CFRP Installer and CFRP Manufacturer and submitted to the Contract Administrator at the Work step specified in the ITP:
    - .1 CD-PM-TO-13: Form 100 – Certificate of Equipment Delivery
    - .2 CD-PM-TO-14: Form 101 – Certificate of Readiness to Install
    - .3 CD-PM-TO-15: Form 102 – Certificate of Satisfactory InstallationTemplates for the above forms can be found in Appendix T.
  - .2 Prior to mobilisation, the CFRP Manufacturer shall provide to the CFRP Installer detailed instructions and advice regarding the requirements for the repair system installation. The CFRP Manufacturer and CFRP Installer shall sign Form 101 to acknowledge that adequate instruction has been provided, and the CFRP Installer is ready.
  - .3 A site visit inspection of the RAS gallery shall be performed by the CFRP Design Engineer prior to mobilization to identify any locations where the design may vary from the pre-award documentation. The Contract Administrator shall be notified of any modifications observed at this time.
  - .4 Following the completion of the installation, the CFRP Manufacturer shall inspect the repair of to verify that it has been installed correctly. The CFRP Manufacturer, CFRP Installer, and Contract Administrator shall sign Form 102. If any deficiencies in the installation are noted at the time of inspection, these shall be reported on Form 102 by the CFRP Design Engineer. The CFRP Installer shall be responsible for the prompt correction of these deficiencies prior to the start-up.
  - .5 The CFRP Design Engineer will be available for inspection of installation and supervision of start-up and commissioning as part of this Contract.
- .9 The CFRP Installer shall be responsible for coordinating the Quality Control and Inspection services provided by the CFRP Design Engineer.

### **3.6 TRAINING**

- .1 At the beginning of the wrap installation, the CFRP Installer shall provide one full 8hr day (1/2-day classroom, 1/2-day field instruction) onsite inspection training course with personnel from the City and the Contract Administrator. This training will be separate from the preventative maintenance training provided at the end of the project. It will include an overall description of the installation process, and inspection requirements for surface preparation and completed composite wrap.
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- .2 After substantial completion, the CFRP Installer shall provide a minimum one full day onsite for formal training session to instruct City staff to perform preventative maintenance inspection and other preventative maintenance measures. Training shall include inspection procedures step by step repair instructions, product names, and product distributors to perform the repair. This is to be scheduled at a mutually acceptable date for the CFRP Installer, Contract Administrator, and City Staff.

### **3.7 PERFORMANCE VERIFICATION**

- .1 In accordance with Section 23 08 01 - Performance Verification of Mechanical Piping.

### **3.8 CLEANING**

- .1 All debris and obstructions shall be removed from the host pipe and disposed of in accordance with the requirements of the contract, and local codes and ordinances.
- .2 Remove all tools, buckets, and materials from Work areas and store neatly at a central location daily at the end of Work. Clean Work areas shall be maintained during construction activities.
- .3 Any excess materials, application tools and containers shall be removed from site by the CFRP Installer.
- .4 Protect adjacent areas from damage, stains, and spillage during delivery of material to repair areas. Repair any damage that occurs as a result of this Work to pre-construction condition or an approved betterment at no cost to the City.
- .5 Protect the Work from damage such as impact, marring of the surfaces, and other damage.
- .6 Maintain control of dust, and debris due to surface preparation in each area of Work. Clean up and remove such material at the completion of each day of Work.

### **3.9 WARRANTY**

- .1 Provide Warranty per D31.

**END OF SECTION**

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- .1 Equipment to operate in extreme operating conditions established in above standard without damage to equipment.
- .3 Language operating requirements: provide identification nameplates and labels for control items in English.

## **1.6 ACTION AND INFORMATIONAL SUBMITTALS**

- .1 Submit in accordance with Section 01 33 00 – Submittal Procedures.
- .2 Product Data
  - .1 Submit manufacturer's instructions, printed product literature and data sheets and include product characteristics, performance criteria, physical size, finish and limitations.
- .3 Shop Drawings:
  - .1 Submit drawings stamped and signed by a professional engineer registered or licensed in the Province of Manitoba, Canada.
  - .2 Submit wiring diagrams and installation details of equipment indicating proposed location, layout and arrangement, control panels, accessories, piping, ductwork, and other items that must be shown to ensure co-ordinated installation.
  - .3 Identify on wiring diagrams circuit terminals and indicate internal wiring for each item of equipment and interconnection between each item of equipment.
  - .4 Indicate of drawings clearances for operation, maintenance, and replacement of operating equipment devices.
  - .5 Submit copies of 600 x 600 mm minimum size drawings and product data to inspection authorities.
  - .6 If changes are required, notify Contract Administrator of these changes before they are made.
  - .7 In addition to transmittal letter referred to in Section 01 33 00 - Submittal Procedures: use MCAC "Shop Drawing Submittal Title Sheet". Identify section and paragraph number.
- .4 Quality Control:
  - .1 Provide CSA certified equipment and material. Where CSA certified equipment and material is not available, submit such equipment and material to inspection authorities for special approval before delivery to site.
  - .2 Submit test results of installed electrical systems and instrumentation.
  - .3 Permits and fees: in accordance with General Conditions of contract.
  - .4 Submit, upon completion of Work, load balance report as described in PART 3 - LOAD BALANCE.
  - .5 Submit certificate of acceptance from inspection authority upon completion of Work to Contract Administrator.
- .5 Manufacturer's Field Reports: submit to Contract Administrator manufacturer's written report, within 3 days of review, verifying compliance of Work and electrical system and instrumentation testing, as described in PART 3 - FIELD QUALITY CONTROL.

## **1.7 CLOSEOUT SUBMITTALS**

- .1 Submit in accordance with Section 01 78 00 - Closeout Submittals.

- 
- .2 Operation and Maintenance Data: submit operation and maintenance data for incorporation into manual.
    - .1 Operation and maintenance manual approved by, and final copies deposited with, the Contract Administrator before final inspection.
    - .2 Operating instructions to include following:
      - .1 Wiring diagrams, control diagrams, and control sequence for each principal system and item of equipment.
      - .2 Start up, proper adjustment, operating, lubrication, and shutdown procedures.
      - .3 Safety precautions.
      - .4 Procedures to be followed in event of equipment failure.
      - .5 Other items of instruction as recommended by manufacturer of each system or item of equipment.
    - .3 Maintenance data to include:
      - .1 Servicing, maintenance, operation and trouble-shooting instructions for each item of equipment.
      - .2 Data to include schedules of tasks, frequency, tools required and task time.
    - .4 Performance data to include:
      - .1 Equipment manufacturer's performance datasheets with point of operation as left after commissioning is complete.
      - .2 Equipment performance verification test results.
      - .3 Special performance data as specified.
    - .5 Approvals:
      - .1 Submit 2 copies of draft Operation and Maintenance Manual to the Contract Administrator for approval. Submission of individual data will not be accepted unless directed by the Contract Administrator.
      - .2 Make changes as required and re-submit as directed by the Contract Administrator.
    - .6 Additional data:
      - .1 Prepare and insert into operation and maintenance manual additional data when need for it becomes apparent during specified demonstrations and instructions.
    - .7 Site records:
      - .1 The Contract Administrator will provide 1 set of reproducible electrical contract drawings. Provide sets of prints as required for each phase of Work. Mark changes as Work progresses and as changes occur. Include changes to existing electrical systems, control systems and low voltage control wiring.
      - .2 Transfer information weekly to reproducibles, revising reproducibles to show Work as actually installed.
      - .3 Use different colour waterproof ink for each service.
      - .4 Make available for reference purposes and inspection.
    - .8 As-built drawings:
      - .1 Prior to start of project closeout, finalize production of as-built drawings.
-

- .2 Identify each drawing in lower right-hand corner in letters at least 12 mm high as follows: - "AS BUILT DRAWINGS: THIS DRAWING HAS BEEN REVISED TO SHOW ELECTRICAL SYSTEMS AS INSTALLED" (Signature of Contractor) (Date).
- .3 Submit to the Contract Administrator for approval and make corrections as directed.
- .4 Submit completed reproducible as-built drawings with Operating and Maintenance Manuals.

## **1.8 DELIVERY, STORAGE AND HANDLING**

- .1 Packing, shipping, handling and unloading:
  - .1 The products shall be delivered in original, unopened containers. Containers shall be clearly marked with legible and intact labels listing the product manufacturer's name, brand name, product identification, batch number, storage conditions, mixing ratios, and shelf-life.
  - .2 Deliver, store and handle materials in accordance with manufacturer's written instructions.
  - .3 Deliver materials to site in original factory packaging, labelled with manufacturer's name, address.
    - .1 Storage and Protection:
    - .2 Protect from weather, construction traffic.
    - .3 Protect against damage.
    - .4 Store at temperatures and conditions required by manufacturer.
- .2 Waste Management and Disposal:
  - .1 Construction/Demolition Waste Management and Disposal: separate waste materials for recycling or reuse.
  - .2 Divert unused metal materials from landfill to metal recycling facility.

## **1.9 QUALITY ASSURANCE**

- .1 Qualifications: electrical Work to be carried out by qualified, licensed electricians who hold valid Master Electrical Contractor license or apprentices as per the conditions of Provincial Act respecting manpower vocational training and qualification.
  - .1 Employees registered in provincial apprentices' program: permitted, under direct supervision of qualified licensed electrician, to perform specific tasks.

## **1.10 SYSTEM STARTUP**

- .1 Instruct Contract Administrator and operating personnel in operation, care and maintenance of systems, system equipment and components.
- .2 Arrange and pay for services of manufacturer's factory service engineer to supervise start-up of installation, check, adjust, balance and calibrate components and instruct operating personnel.
- .3 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with aspects of its care and operation.

**Part 2 Products**

**2.1 MATERIALS AND EQUIPMENT**

- .1 Material and equipment to be CSA certified. Where CSA certified material and equipment is not available, obtain special approval from inspection authorities before delivery to site and submit such approval as described in PART 1 – ACTION AND INFORMATIONAL SUBMITTALS.

**2.2 ELECTRIC MOTORS, EQUIPMENT AND CONTROLS**

- .1 Verify installation and co-ordination responsibilities related to motors, equipment and controls, as indicated.

**2.3 WARNING SIGNS**

- .1 Warning Signs: in accordance with requirements of inspection authorities and Contract Administrator.
- .2 Decal signs, minimum size 175 x 250 mm.

**2.4 WIRING TERMINATIONS**

- .1 Ensure lugs, terminals, screws used for termination of wiring are suitable for either copper or aluminum conductors.

**2.5 EQUIPMENT IDENTIFICATION**

- .1 Identify electrical and controls equipment and instrumentation with nameplates and labels as follows:

- .1 Nameplates: lamicoid 3 mm melamine, black face, white core, lettering accurately aligned and engraved into core mechanically attached with self tapping screws.
- .2 Sizes as follows:

NAMEPLATE SIZES			
Size 1	10 x 50 mm	1 line	3 mm high letters
Size 2	12 x 70 mm	1 line	5 mm high letters
Size 3	12 x 70 mm	2 lines	3 mm high letters
Size 4	20 x 90 mm	1 line	8 mm high letters
Size 5	20 x 90 mm	2 lines	5 mm high letters
Size 6	25 x 100 mm	1 line	12 mm high letters
Size 7	25 x 100 mm	2 lines	6 mm high letters
Size 8	50 x 100 mm	2 lines	12 mm high letters

- .2 Labels: embossed plastic labels with 6 mm high letters unless specified otherwise.
- .3 Wording on nameplates and labels to be approved by Contract Administrator prior to manufacture.
- .4 Allow for minimum of twenty-five (25) letters per nameplate and label.
- .5 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.
- .6 Identify equipment with Size 3 labels engraved as directed by Contract Administrator. Eg. "P600"

- .7 Terminal cabinets and pull boxes: indicate system and voltage.

## **2.6 WIRING IDENTIFICATION**

- .1 Identify wiring with permanent indelible identifying markings, coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.
- .2 Maintain phase sequence and colour coding throughout.
- .3 Colour coding: to CSA C22.1.
- .4 Use colour coded wires in communication cables, matched throughout system.
- .5 Identify each wire at termination points with unique wire tag, generally to match existing or as shown on the drawings. Markers shall consist of machine printed sleeves.

## **2.7 FLOW INSTRUMENTS**

- .1 All flow instruments shall be supplied in accordance with instrument datasheets included in Appendix P.
- .2 All flow meters shall be supplied by the Standardized Manufacturer as outlined below:
  - .1 Manufacturer: Siemens
  - .2 Company: Trans-West Inc.
  - .3 Address: 126 Bannister Rd., Winnipeg, MB, R2R 0S3.
- .3 Flow instruments shall meet all requirements as outlined in Part E3 - Standardized Instrumentation of the Tender.

## **Part 3 Execution**

### **3.1 SAFETY**

- .1 Compliance with OSHA and other safety laws and regulations is the exclusive responsibility of the Contractor, their Subcontractors, their suppliers, consultants, and workers.

### **3.2 INSTALLATION**

- .1 Do complete installation in accordance with CSA C22.1 except where specified otherwise.
- .2 Do overhead and underground systems in accordance with CSA C22.3 No.1 except where specified otherwise.

### **3.3 NAMEPLATES AND LABELS**

- .1 Ensure manufacturer's nameplates, CSA labels and identification nameplates are visible and legible after equipment is installed.

### **3.4 MOUNTING HEIGHTS**

- .1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.
-

- .2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation. Install electrical equipment at the following heights unless indicated otherwise.

### **3.5 FIELD QUALITY CONTROL**

- .1 Conduct following tests:
  - .1 Flow meters, Motors, and associated control equipment including sequenced operation of systems where applicable.
- .2 Carry out tests in presence of Contract Administrator.
- .3 Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
- .4 Manufacturer's Field Services:
  - .1 Obtain written report from manufacturer verifying compliance of Work, in handling, installing, applying, protecting and cleaning of product and submit Manufacturer's Field Reports as described in PART 1 – ACTION AND INFORMATIONAL SUBMITTALS.
  - .2 Provide manufacturer's field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with manufacturer's instructions.

### **3.6 QUALITY CONTROL**

- .1 The following City of Winnipeg standard forms must be signed by the General Contractor and Fabricator as they apply to the Scope of Work as outlined on the drawings and in the specifications:
  - .1 CD-PM-TO-13: Form 100 – Certificate of Equipment Delivery
  - .2 CD-PM-TO-14: Form 101 – Certificate of Readiness to Install
  - .3 CD-PM-TO-15: Form 102 – Certificate of Satisfactory Installation

### **3.7 COMMISSIONING**

- .1 The following City of Winnipeg standard forms must be signed by the Contractor and their suppliers, consultants, and/or subcontractors as required and submitted to the Contract Administrator:
  - .1 CD-PM-TO-16: Form 103 – Certificate of Equipment Satisfactory Performance
  - .2 CD-PM-TO-17: Form 104 – Certificate of Satisfactory Process Performance

See Commissioning Plan document for further details.

### **3.8 CLEANING**

- .1 Progress Cleaning: clean in accordance with Manufacturer's recommendations.
  - .1 Leave Work area clean at end of each day.
- .2 Final Cleaning: upon completion remove surplus materials, rubbish, tools and equipment.

### **3.9 PROTECTION**

- .1 Protect installed products and components from damage during construction.

**END OF SECTION**

**Part 1            General**

**1.1                RELATED SECTIONS**

- .1            Section 26 05 01 – Common Works Results – For Electrical

**Part 2            Products**

**2.1                SUPPORT CHANNELS**

- .1            U shape, size 41 x 41 mm, 2.5 mm thick, surface mounted or suspended.

**Part 3            Execution**

**3.1                INSTALLATION**

- .1            Secure equipment to solid masonry, tile and plaster surfaces with lead anchors or nylon shields.
- .2            Secure equipment to poured concrete with expandable inserts.
- .3            Secure equipment to hollow masonry walls or suspended ceilings with toggle bolts.
- .4            Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.
- .5            Fasten exposed conduit or cables to building construction or support system using straps.
  - .1            One-hole steel straps to secure surface conduits and cables 50 mm and smaller.
  - .2            Two-hole steel straps for conduits and cables larger than 50 mm.
  - .3            Beam clamps to secure conduit to exposed steel work.
- .6            Suspended support systems.
  - .1            Support individual cable or conduit runs with 6 mm dia threaded rods and spring clips.
  - .2            Support 2 or more cables or conduits on channels supported by 6 mm dia threaded rod hangers where direct fastening to building construction is impractical.
- .7            For surface mounting of two or more conduits use channels at 1.5 m on centre spacing.
- .8            Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.
- .9            Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.
- .10           Do not use wire lashing or perforated strap to support or secure raceways or cables.
- .11           Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of Contract Administrator.
- .12           Install fastenings and supports as required for each type of equipment cables and conduits, and in accordance with manufacturer's installation recommendations.

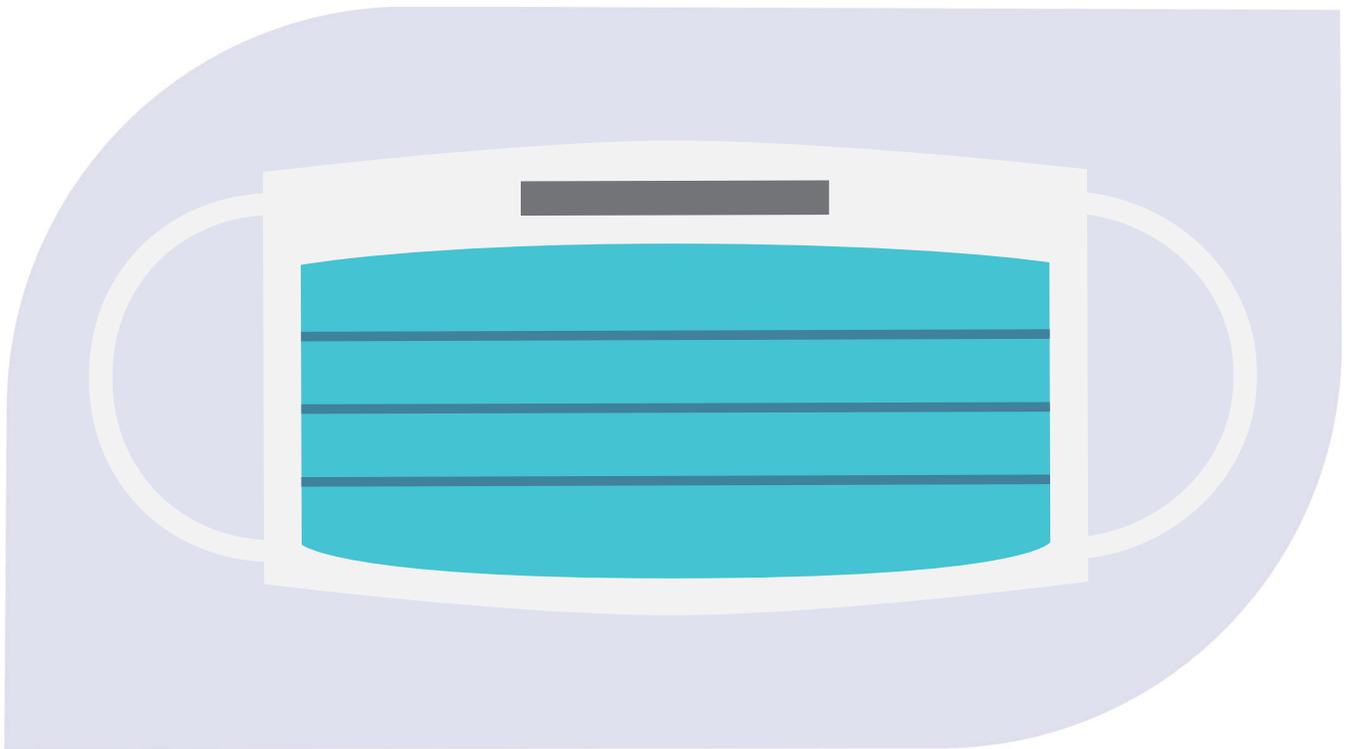
**END OF SECTION**

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## **APPENDIX A – MASKS REQUIRED IN CITY-OPERATED FACILITIES POSTER**

**Masks are required  
in this City-operated facility**

**Le port du masque est obligatoire  
dans cette installation  
exploitée par la Ville.**



**Masks are required  
in this City-operated facility**

**Le port du masque est obligatoire  
dans cette installation  
exploitée par la Ville.**



## Quand faut-il porter un masque?

Il faut porter un masque qui recouvre la bouche, le nez et le menton en tout temps sauf dans certains cas, dont voici quelques exemples :

- les personnes âgées de moins de cinq ans;
- les personnes qui ne peuvent pas mettre, utiliser ou enlever un masque sans se faire aider;
- les personnes qui ne peuvent pas porter un masque en raison d'un problème ou d'une incapacité mentale ou physique, ou qui font l'objet d'une protection en vertu du Code des droits de la personne du Manitoba;
- les personnes qui mangent ou boivent dans des espaces désignés où l'on peut s'asseoir, ou dans le cadre d'une cérémonie religieuse ou spirituelle;
- les personnes qui pratiquent des activités aquatiques ou qui font de l'exercice;
- les personnes qui donnent des soins ou de l'aide à des personnes handicapées que le port du masque gênerait dans le cadre de leur travail;
- les personnes qui doivent temporairement enlever leur masque pour accomplir leurs tâches ou offrir leurs services (p. ex. pour mettre un respirateur);
- les membres du personnel de la Ville qui travaillent seuls dans des espaces complètement fermés tels qu'un bureau ayant une porte fermée, qui voyagent seuls dans un véhicule ou qui travaillent seuls dans un espace cloisonné situé à au moins deux mètres des autres employés;
- le personnel des services d'urgence, y compris les agents de police, les pompiers et les ambulanciers paramédicaux en service qui doivent déjà suivre des protocoles internes stricts en matière de protection de la santé et de la sécurité propres à leur service.

## When are face masks required?

All individuals required to wear a face mask in all indoor City-operated facilities and vehicles with the following exemptions:

- Persons under the age of five
- Persons who are unable to place, use, or remove a mask without assistance
- Persons unable to wear a mask due to a mental or physical concern or limitation, or protected ground under the Manitoba Human Rights Code
- Persons consuming food or drink in designated seating areas or as part of religious or spiritual ceremony
- Persons engaged in water activities or physical exercise
- Persons providing care or assistance to a person with a disability where a mask would hinder that caregiving or assistance
- Persons engaging in tasks or services that require the temporary removal of a mask (e.g. in order to don a respirator)
- City employees who are working alone in fully-enclosed space, such as an office with the door closed or travelling along in a City vehicle, as well as employees working in a cubicle and separated from others by a partition and at least two meters
- Emergency services personnel, including police officers, firefighters and paramedics, while on duty as they already follow stringent additional health and safety internal department protocols

## **APPENDIX B – HOW TO SAFELY USE A NON-MEDICAL MASK OR FACE COVERING**

# HOW TO SAFELY USE A NON-MEDICAL MASK OR FACE COVERING

## DO'S



**DO** wear a non-medical mask or face covering to protect others.



**DO** ensure the mask is made of at least two layers of tightly woven fabric.



**DO** inspect the mask for tears or holes.



**DO** ensure the mask or face covering is clean and dry.



**DO** wash your hands or use alcohol-based hand sanitizer before and after touching the mask or face covering.



**DO** use the ear loops or ties to put on and remove the mask.



**DO** ensure your nose and mouth are fully covered.



**DO** replace and launder your mask whenever it becomes damp or dirty.



**DO** wash your mask with hot, soapy water and let it dry completely before wearing it again.



**DO** store reusable masks in a clean paper bag until you wear it again.



**DO** discard masks that cannot be washed in a plastic-lined garbage bin after use.

## DO YOUR PART.

Wear a non-medical mask or face covering to protect others when you can't maintain a 2-metre distance.

### NON-MEDICAL MASKS ARE NOT RECOMMENDED FOR:

- People who suffer from an illness or disabilities that make it difficult to put on or take off a mask
- Those who have difficulty breathing
- Children under the age of 2

## DON'T JUDGE OTHERS FOR NOT WEARING A MASK.

Kindness is important as some people may not be able to wear a mask or face covering.

## DON'TS



**DON'T** reuse masks that are moist, dirty or damaged.



**DON'T** wear a loose mask.



**DON'T** touch the mask while wearing it.



**DON'T** remove the mask to talk to someone.



**DON'T** hang the mask from your neck or ears.



**DON'T** share your mask.



**DON'T** leave your used mask within the reach of others.

**REMEMBER**, wearing a non-medical mask or face covering alone will not prevent the spread of COVID-19. You must also wash your hands often, practise physical distancing and stay home if you are sick.



# UTILISATION SÛRE D'UN MASQUE NON MÉDICAL OU D'UN COUVRE-VISAGE

## À FAIRE



**PORTEZ** un masque non médical ou un couvre-visage pour protéger les autres.



**ASSUREZ-VOUS** que le masque est constitué d'au moins deux couches de tissu tissé serré.



**INSPECTEZ** le masque pour voir s'il y a des déchirures ou des trous.



**ASSUREZ-VOUS** que le masque ou le couvre-visage est propre et sec.



**LAVEZ-VOUS** les mains ou utilisez un désinfectant pour les mains à base d'alcool avant de toucher votre masque ou votre couvre-visage, et après l'avoir fait.



**TOUCHEZ** uniquement les attaches qui passent derrière les oreilles ou la tête pour enfiler et retirer le masque.



**ASSUREZ-VOUS** que votre nez et votre bouche sont entièrement couverts.



**REMPLECEZ** et lavez votre masque s'il devient humide ou souillé.



**LAVEZ** votre masque à l'eau chaude savonneuse et laissez-le sécher complètement avant de le porter de nouveau.



**ENTREPOSEZ** vos masques réutilisables dans un sac en papier propre jusqu'à ce que vous les portiez de nouveau.



**JETEZ** les masques non lavables dans une poubelle doublée d'un sac de plastique après utilisation.

## À ÉVITER



**NE RÉUTILISEZ PAS** les masques qui sont humides, sales ou endommagés.



**NE PORTEZ PAS** un masque trop ample.



**NE TOUCHEZ PAS** le masque lorsque vous le portez.



**N'ENLEVEZ PAS** votre masque pour parler à quelqu'un.



**NE LAISSEZ PAS** le masque pendre à votre cou ou à vos oreilles.



**NE PRÊTEZ PAS** votre masque.



**NE LAISSEZ PAS** un masque usagé à la portée des autres.

## FAITES VOTRE PART

Portez un masque non médical ou un couvre-visage pour protéger les autres lorsque vous ne pouvez pas maintenir une distance de 2 mètres.

### LES MASQUES NON MÉDICAUX NE SONT PAS RECOMMANDÉS POUR :

- les personnes atteintes d'une maladie ou d'un handicap qui complique le port ou le retrait d'un masque;
- les personnes qui ont des problèmes respiratoires;
- les enfants de moins de deux ans.

## NE JUGEZ PAS CEUX QUI NE PORTENT PAS DE MASQUE.

La gentillesse est de mise, car certaines personnes ne peuvent pas porter de masque ou de couvre-visage.

N'oubliez pas que le seul fait de porter un masque non médical ou un couvre-visage n'empêchera pas la propagation de la COVID-19. Vous devez également vous laver souvent les mains, maintenir une distance physique avec les autres et rester à la maison si vous êtes malade.



**APPENDIX C - COVID SCREENING QUESTIONNAIRE**



## COVID-19 Daily Self-Screening Questionnaire

**These are questions that employees should ask themselves prior to starting to their work day:**

Any employee who is experiencing ANY of the symptoms below, **even if fully vaccinated**, should NOT enter the workplace. You should still be tested even if your symptoms are very mild or if they start to improve after 24 hours. It is important to get tested as tracing and isolating contacts in a timely manner is important to limiting the spread of COVID-19 in the community.

Do you have any of the below symptoms?		
Feeling of fever or chills?	Yes	No
New onset of cough or increase in amount of coughing?	Yes	No
Sore throat? Hoarse voice?	Yes	No
Experiencing fatigue?	Yes	No
Pink eye?	Yes	No
Have a skin rash of an unknown cause?	Yes	No
Shortness of Breath?	Yes	No
New onset symptom: runny nose/ congestion?	Yes	No
Headache or unusual headache?	Yes	No
Sore muscles not related to overexertion or exercise?	Yes	No
New onset symptom: diarrhea? Vomiting?	Yes	No
New onset symptom: loss of taste and/or smell?	Yes	No
Have you or a member of your household had close contact (within two metres) with a confirmed case of COVID-19?	Yes	No
Are you, or a member of your household, waiting for COVID-19 testing results?	Yes	No
Is a member of your household sick with COVID-19 symptoms, and waiting for COVID-19 test results?	Yes	No
Have you been exposed to COVID-19 in a work or public setting in the last 14 days? (e.g. a setting that has been identified by public health as a risk for acquiring COVID-19, such as on a flight, at a workplace or in a community with a cluster of cases, or at an event?)	Yes	No
Have you received a notification from the COVID Alert app that you may have been exposed to COVID-19?	Yes	No
Have you or a member of your household been identified as a close-contact and instructed to self-isolate?	Yes	No
In the last 14 days, have you returned: <ul style="list-style-type: none"> <li>From a Canadian province/territory and you have less than two COVID vaccinations or it has been less than two weeks since your second COVID vaccination?</li> <li>From non-essential travel outside Canada?</li> </ul> Travel restrictions are subject to change; up-to-date information is available at: <a href="https://www.gov.mb.ca/covid19/soe.html">https://www.gov.mb.ca/covid19/soe.html</a>	Yes	No
<b>IF ALL ANSWERS ARE NO</b>		
<ul style="list-style-type: none"> <li>Clean your hands again and enter the work location</li> </ul>		
<b>IF ANY ANSWERS ARE YES</b>		
<ul style="list-style-type: none"> <li><b>DO NOT ENTER FURTHER INTO THE WORK LOCATION</b></li> <li>Contact your workplace supervisor</li> <li>Contact Occupational Health: 204-986-5218</li> <li>Return home maintaining physical distancing</li> <li>Complete the on-line screening tool; <a href="https://sharedhealthmb.ca/covid19/screening-tool/">https://sharedhealthmb.ca/covid19/screening-tool/</a></li> </ul>		

**APPENDIX D - CONSTRUCTION PLAN**

**CITY OF WINNIPEG**

Tender No.: 538-2021

NON-METALLIC COMPOSITE REPAIR SYSTEM FOR NEWPCC  
RAS PIPING SYSTEM REFURBISHMENT

## Construction Plan - FINAL

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Final:

Rev 0

Date:

September 15, 2021

KGS Group Project:

21-0107-001



2021-09-15

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Senior Mechanical Engineer

REVIEWED BY:



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Appendix B: Risk Assessment

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## 1.0 INTRODUCTION

The North End Sewage Treatment Plant (NEWPCC) is the largest of three sewage treatment plants servicing the City of Winnipeg. The Return Activated Sludge (RAS) piping system conveys effluent from the Secondary Clarifiers to the High Purity Oxygen (HPO) tanks. The trunk pipework of the system consists of approximately 600 meters of pipe, ranging from 300 millimeters to 900 millimeters in diameter, and many valves, flowmeters, and pumps. Reliable operation of the RAS piping system is critical to the operation of the plant. However, the RAS piping system, installed in the late 1980s, is beyond its design service life and several leaks have started.

A minimum extended piping design life of twenty-five years is conservatively sufficient to cover the remaining service life of RAS piping system. This project was conceived as part of the Water and Waste Asset Refurbishment and Replacement Program for repair or replacement of the piping to mitigate risk of further deterioration, and to restore the system to a condition that can provide that minimum service life.

This construction plan document provides the details of the proposed construction plan to refurbish the RAS piping encompassed by this project with an engineered external non-metallic composite repair system. The plan indicates who the project personnel are and what the communication links between them will be. A project outline schedule is presented to illustrate the timeframe to complete the work.

The document is separated into sections defined by the applicable phase of construction. Each section describes generally the work done by the General Contractor, the Carbon Fiber Reinforced Plastic (CFRP) Installer, and the Electrical Subcontractor and the steps involved in each task. It also discusses illustrates how to minimize the risk to the project schedule posed by unpredictable weather, materials procurement, and other risks to the work at the North End treatment plant.

## 2.0 PROJECT CONTACT PERSONNEL

Communication for the project will be between various City, Contract Administrator, and Contractor personnel. The following plan for lines of communication is to be observed by the Contractor, and Subcontractors. See key instructions for communication listed below:

The Contractor will direct all enquiries and requests for clarification to Contract Administrator directly and copy City Project Manager. Contract Administrator will review with the City if necessary and advise the Contractor how to proceed.

### **Contract Administrator:**

Prasan Silva, P.Eng.

KGS Group

- Mobile: 204 998 2278
- Email: [psilva@ksgroup.com](mailto:psilva@ksgroup.com)

### **City Project Manager:**

Brian Station, P.Eng.

City of Winnipeg – Water and Waste Department

- Mobile: 204-232-0317
- Email: [bstation@winnipeg.ca](mailto:bstation@winnipeg.ca)

A table of contact persons and their information is provided in Appendix A. The Contractor may contact additional project personnel with Contract Administrator approval only. All correspondence between the Contractor and additional project personnel must be copied to the Contract Administrator and City Project Manager.

### 3.0 PROJECT CONSTRAINTS

The critical scheduling limitation for this project is the annual shut-down window between December and March. At this time of year, the flow of wastewater to the plant is lowest due to the typically cold and dry conditions in the City. Because each train of the RAS piping system represents such a large segment of the total plant capacity, none may be shut-down for more than a few days at a time during this window. All work must be planned to limit the amount of time that each train is shut down, and respect the limited window.

Another constraint on this project will be the limited access to the space. The RAS piping gallery is located below ground level and has few entry points large enough to move equipment in and out of the space. The blower room located south of the RAS gallery has roof opening that may be used to lower materials into the space. Access to the blower room shall be coordinated with NEWPCC maintenance staff. An overhead hoist allows those materials to be lifted east/west across the gallery, as far as the HPO tanks on the far west side. In some cases, the space constraints between piping and structure will physically limit the installation of new equipment or material.

The Risk Assessment Document (See Appendix B) illustrates the full set of project risks considered by the Contract Administrator. The Contractor shall review this list and accept the responsibility to mitigate the risks described.

## 4.0 CONSTRUCTION SCHEDULE

The scheduled award for the construction contract is November of 2021. The RAS train shutdowns required for contract work are planned to occur during the winter season of 2021/22 when sewage flows are lowest. The winter season typically can start as early as September and ends as late as March. However, this cannot be predicted accurately. Therefore, the work must be planned to best exploit the available time. This will allow for the largest possible time contingency to prevent work that requires a shut down running into the March/April time frame. (A preliminary construction schedule is provided in Appendix C.)

The overall scope of work is broken into four main construction phases:

- Project Start-up: Document submittal reviews, mock-up testing, and mobilization
- Early Construction Works: Initial application of composite pipe wrap repair to existing leaks that urgently require repair.
- Construction Work Requiring Shutdown: Replacement of existing piping, valves, and flow meters at the connections to the HPO tanks.
- Construction Work During Operation: System wide application of composite pipe wrap repair
- Project Closeout: Final inspection, de-mobilization, and performance verification.

Each phase will require different levels of effort from the Contractor, CFRP Installer, and the Electrical Subcontractor. Some amount of overlap will occur between each phase due to work that is unrelated but can be performed concurrently. See the proposed sequence of work for each category provided in Appendix D.

### 4.1 Project Start-Up

Prior to, and immediately after, the award of the construction contract, the proponent will be required to submit documentation for review by the Contract Administrator. The documentation will mostly relate to the installation of the composite wrap repair system, however, there will be shop drawings for equipment and pipe supports as well. The submittal review will include:

- Method of Application Report
- Qualification Data
- Design Details
- Design Calculations
- Procurement (Vendor Data)

Each document will be reviewed and returned to the Contractor, and in some cases further re-submittals will be necessary. Confirmation of the technical details surrounding the wrap installation will be necessary in advance of proceeding with the mock-up test spool fabrication and testing. Approval of shop drawings, and procurement of long-lead items such as valves and flow-meters should be prioritized to prevent later delays.

With acceptance of the full set of pre and post award submittals, the Contractor will proceed with the fabrication of the mock-up test spools. Once complete, the CFRP installer will apply the composite wrap repair system to the exterior of the spools. The Contractor will then ready the spools for testing, carry-out the tests, and report the results. If revisions to the pre-award application method documents are necessary, these will be resubmitted to the Contract Administrator for review.

As the testing reaches completion, the contract will begin mobilizing their staff and equipment to the NEWPCC facility. When ready, the City will hand over partial control of the RAS Pipe Gallery area to the Contractor and their Subcontractors. However, because the system will remain in operation for the majority of the work, the City will require continuous access to specific areas of the gallery. These include access to the sampling locations, and to the manual isolation valves.

At the beginning of the wrap installation, the CFRP Installer shall provide one full day onsite inspection training course with personnel from City and the Contract Administrator. This training will be separate from the preventative maintenance training provided at the end of the project.

## 4.2 Early Construction Works

The City had observed many new leaks on the RAS train trunk piping prior to the project. Furthermore, during recent site visits, new leaks have been observed. Some of these are at welds and some are at pin holes near the invert of the pipe. In many cases, attempts have been made to stop or reduce leaking. As a precautionary measure, the City has requested that the new composite wrap repair system is applied to these locations urgently after the award of the contract to prevent further leaking, and worsening of the local corrosion. The urgent repairs made will be provided concurrently at several locations.

## 4.3 Construction Work Requiring Shut-down

Replacement of the pipe spools upstream of the tie-in of each RAS train to the High Purity Oxygen tanks will require a temporary shut-down of each RAS train. Because the RAS system is critical to the operation of the treatment plant, no two RAS trains can be shut-down simultaneously, and they may only be shut-down one at a time during the low-flow winter season. Each shut down requires a continuous and un-interrupted work effort on the part of the Contractor to minimize the length of the shut down and reduce impact of the work on the treatment plant operation. Each shut down is followed by a 15-day (minimum 2-3 Solids Retention Time (SRT) periods) performance verification period to verify the stability of the water treatment process.

The piping, valves, and flow meters together comprise a single spool piece when assembled. However, the ball valves will be left in position on the supports, so that they may be locked-out with controls remaining intact to reduce start-up and commissioning requirements.

The replacement spools for RAS train nos. 2 and 3 will require that the RAS train is shut-down and partially drained so that each spool can be fully drained, and removed. The pumps on that train will be shut-off, and the clarifiers temporarily de-activated. The HPO tank will then be drained, such that the portion of the RAS train pipe that is above the invert of the connecting pipe will be empty. The low-point drains on the straight sections can then be opened to remove any remaining fluid. The spools can then be replaced.

RAS train no. 1 will have to be fully drained due to the piping arrangement, and the resulting developed head upstream of the connection to the HPO tank. To do this, the same procedure of shutting off the pumps and draining the HPO tank will be done. However, it will result in draining a larger portion of the RAS train. The same low-point drains again will be used to remove the remaining fluid. Due to the limited time available in the 2021-2022 winter shut down season, and the more complicated shut down requirements for RAS train 1, the shutdown work and performance verification period for this train are scheduled for the subsequent 2022-2023 window.

Commissioning of each of the new RAS flow meters will occur independently after each RAS train is shut down. Commissioning of the new flowmeters shall consist of the following:

- Loop wiring checks.
- Instrument calibration.
- Verification that range specified in plant DCS matches range of the flow transmitter.
- Verification of read-out on plant DCS (0%, 50%, and 100% signal).

#### 4.4 Construction Work During Operation

The application of the composite wrap repair to the entirety of the RAS piping will be done while the system is in operation. Because of this, there is currently no preferred order in which it is to be completed. The pipe wrap can be applied in sections to all three train simultaneously, or to one train at a time. The length, start and finish locations of sections within the boundaries of the project scope is at the discretion of Contractor. This work does not need to be scheduled during the low flow season exclusively and can be done concurrently with any other work.

To replace WAS piping, new lines will be routed adjacent to the existing pipe between the control valve at the tie-in to the RAS train to the connection to the WAS pump suction header. The existing sections of WAS piping that are to be replaced will remain in operation while new piping is installed. This will allow the scheduling of the new pipe installation to be at the discretion of the Contractor as well.

Tie-in of each new pipe segment will necessitate a shut-down of that specific WAS header. The treatment process is less sensitive to the shut-down of the WAS system, however, this activity is scheduled during the 2022-2023 winter shut down season to reduce likelihood of process issues. The WAS header tie-in is scheduled to coincide with the RAS train no.1 shut down to reduce interference with the process. Like the RAS flow meters, commissioning of the new WAS flow meters will occur after each WAS header tie-in is complete.

#### 4.5 Project Close-out

Generally, the effort required for commissioning is anticipated to be small, due to the lack of changes to the existing equipment and will occur at various stages through-out the project. Commissioning will not be reserved for the end of the project as is typically done.

Final inspection services will be provided by the CFRP Design Engineer of the composite wrap repair, and a report will be provided. Final review and signature of the QC documents, and other deliverables will be done

by the CFRP Installer, CFRP Manufacturer, and CFRP Design Engineer. De-mobilization of the project work site will be performed, and the site cleaned up.

After substantial completion, the CFRP Installer shall provide a minimum one full day onsite for formal training session to instruct City staff to perform small repairs and other preventative maintenance measures. Training shall include step by step repair instructions, product names, and product distributors to perform the repair.

## 5.0 CONCLUSION

This report has presented the details of the construction sequence for the refurbishment project. Each portion of construction activity has been described with pertinent details highlighted. The scheduling and sequence of work provided are intended to be guidelines for the Work, and the Contractor must undertake each stage/phase in the way the is deemed to be most efficient for the project. Discrepancies or deviations should be reported as soon as they are noted.

# **APPENDIX A**

Contact Information Table

**Tender No . 538-2021: CONSTRUCTION PLAN - APPENDIX A**  
**CONTACT LIST - (to be updated by Contractor)**

First	Last	Organization	Role	Phone	Email
<b>Contractor:</b>					
name	name	CONTRACTOR	Project Manager		
name	name	CONTRACTOR	Job Superintendent		
name	name	CONTRACTOR	Field Supervisor (Foreman)		
name	name	SUBCONTRACTOR_FRP INSTALLER	Project Manager		
name	name	SUBCONTRACTOR_FRP INSTALLER	Job Superintendent		
name	name	SUBCONTRACTOR_FRP INSTALLER	Field Supervisor (Foreman)		
name	name	ELECTRICAL SUBCONTRACTOR	Project Manager		
name	name	ELECTRICAL SUBCONTRACTOR	Job Superintendent		
name	name	ELECTRICAL SUBCONTRACTOR	Field Supervisor (Foreman)		
(additonal trades)					
<b>KGS Group:</b>					
Prasan	Silva	KGS GROUP	Contract Administrator	204-318-2202	<a href="mailto:psilva@ksgsgroup.com">psilva@ksgsgroup.com</a>
Adam	Pawlikewich	KGS GROUP	Project Manager	204-478-3244	<a href="mailto:apawlikewich@ksgsgroup.com">apawlikewich@ksgsgroup.com</a>
Jason	Smith	KGS GROUP	Senior Mechanical Engineer	204-478-3214	<a href="mailto:jsmith@ksgsgroup.com">jsmith@ksgsgroup.com</a>
Colburn	Holbrook	KGS GROUP	Mechanical Engineer	204-998-7929	<a href="http://cholbrookksgsgroup.com">cholbrookksgsgroup.com</a>
Ali	Alimujiang	KGS GROUP	Electrical Engineer	204-896-1209	<a href="mailto:aalimujiang@ksgsgroup.com">aalimujiang@ksgsgroup.com</a>
Jonathan	Walter	KGS GROUP	Structural Engineer	204-896-1209	<a href="mailto:jwalter@ksgsgroup.com">jwalter@ksgsgroup.com</a>
<b>City of Winnipeg:</b>					
Brian	Station	CITY WWSD	Project Manager	204-232-0317	<a href="mailto:bstation@winnipeg.ca">bstation@winnipeg.ca</a>
Brendan	Hellrung	CITY WWSD	NEWPCC Operations Lead	204-986-4800	<a href="mailto:bhellrun@winnipeg.ca">bhellrun@winnipeg.ca</a>
Richard	Ramrattan	CITY WWSD	Senior Project Engineer	204-803-0074	<a href="mailto:rramrattan@winnipeg.ca">rramrattan@winnipeg.ca</a>

# **APPENDIX B**

Risk Assessment

Risk Management Plan (RMP) - DRAFT

Project	NEWPCC RAS Piping System Refurbishment Project S-1163	Date	2021-04-20
		Prepared by	KGS Group
Description	NEWPCC - RETURN ACTIVATED SLUDGE PIPING SYSTEM REFURBISHMENT		

System		Program Information about the Risk Event		Risk Event Identification				Risk Event Assessment			CHAIR-1 Study Guidewords		Risk Response Assessment (based on an Implemented Risk Management Plan - future state)				Risk Response Plan - Execution Log				
Risk ID; Sequential ID	Last Reviewed Date	Identification Date	Category of Risk; Design, Construction, HR, Procurement etc.	Threat or Opportunity (T / O)	Due to (Cause Event)	This could occur (Result Event)	Resulting in (this Effect)	Status (Identified / In Development / Defined / Closed)	Magnitude of Risk Event(1-5)	Likelihood (1-5)	Assessed Score C X L	Generic/ Overview	Guideword	Risk Response Type (Avoidance, Transference, Mitigation, Acceptance)	Risk Response Plan - Actions	Residual Magnitude occur (1-5)	Residual Likelihood (1-5)	Assessed Residual Score	Comments	Risk Level Before Mitigation	Risk Level After Mitigation
1.01	2021-03-30	2021-03-26	Design	T	New quantity of FRP pipe wrap and flame characteristics of pipe wrap.	Change to fire hazard in RAS pipe gallery area	Added scope - Fire suppression system required for the space	Defined	4	3	12	CHAIR 1 OVERVIEW 5	FIRE / EXPLOSION	Mitigation	As part of detailed design Determine flame and smoke spread characteristics of pipe wrap and applicable code limits.	2	1	2		High	Low
1.02	2021-03-30	2021-03-26	Design	T	Different coefficient of thermal expansion	Added stress on pipe and pipe wrap	Cracks, deflection in pipe wrap and piping resulting in more leaks	Defined	4	2	8	CHAIR 1 GENERIC 7	LOAD / FORCE	Transference of mitigation	Wrap provider to include expansion joints in wrap repair design to allow for differential growth. - Define temperature parameters and make contractor responsible for the design within those parameters	2	1	2		Critical	Low
1.03	2021-03-30	2021-03-26	Design	T	Continued degradation of steel pipe inside external wrap	Significant size pieces could break off inside pipe	Loss of structural integrity of original pipe	Defined	4	1	4	CHAIR 1 OVERVIEW 16	DETERIORATION	Transference	Design wrap system for complete loss of original pipe structural integrity	1	1	1		High	Low
1.04	2021-03-30	2021-03-26	Design	T	Continued degradation of steel pipe inside external wrap	Significant size pieces could break off inside pipe	Partial blockage, flow restriction	Defined	4	1	4	CHAIR 1 OVERVIEW 16	DETERIORATION	Accept or mitigate	Is there a design solution which does not cause more work than simply removing debris in case of issue. - Touch base with manufacturers - is this an issue? Contingency plan required if we accept.			0		High	Not Assessed
1.05	2021-03-30	2021-03-26	Design	T	Wrap adds weight	Exceeds capacity of existing supports	Additional supports or strengthening of supports required.	Defined	3	5	15	CHAIR 1 GENERIC 7	LOAD / FORCE	Transference	Wrap provider to design for additional weight, add supports if needed - RFP indicates existing structure clearly.	3	1	3		Extm	Med
1.06	2021-03-30	2021-03-26	Design	T	Wrap adds weight	Added stress on pipe and pipe wrap between supports	Cracks, deflection in pipe wrap and piping resulting in more leaks	Defined	5	2	10	CHAIR 1 GENERIC 7	LOAD / FORCE	Mitigation	Provide additional supports if required - as above - Clarify new vs. temporary vs locations. KGS to clarify structural conditions for support, final pipe wrap will require support design by vendor. Clear indication of review. Also include clearances for maintenance - Breach clearance only if very needed and approved by City - ADD CONTINGENCY FOR WHAT HAPPENS - SPECIFIC EMERGENCY RESPONSE PLAN FOR THESE	4	1	4		High	High
1.07	2021-03-30	2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	Removal and reinstallation of pipe leads and unloads connecting pipework.	Added stress on pipe and pipe wrap between supports. Damage to pipe creates new leak.	Cracks, deflection in pipe wrap and piping resulting in more leaks	Defined	4	2	8	CHAIR 1 GENERIC 7	LOAD / FORCE	Transference	Provide temporary and additional supports as required - as above	3	1	3		Serious	Low
1.08		2021-04-19	Design	T	Wrap strength is less than existing pipe	Loss of pipe integrity results in leaks and cracks in wrap	Future repairs within 25 year design life	Identified	5	2	10	CHAIR 1 GENERIC 7	LOAD / FORCE	Mitigation	Design wrap system for 25 years	3	1	3		Low	Low
1.09		2021-04-19	Design	T	Cracks in wrapped pipe leak into interstitial space between wrap and pipe wall	Rapid corrosion of interior and exterior of pipe	Future repairs within 25 year design life	Identified	5	2	10	CHAIR 1 GENERIC 7	LOAD / FORCE	Mitigation	Design wrap system for 25 years	3	1	3		Low	Low
2.01	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Pipework at high level - not easily accessed	Falls	Injury to City Employees, falls etc.	Defined	4	3	12	CHAIR 1 GENERIC 3	HEIGHTS/DEPTHS	Mitigation	Contractor will have control of the space - City will have limited access during construction - 1 year. City will define what access they need. Selecting experienced and competent contractor, proper scaffolding procedures, use appropriate SWPs.	4	1	4		Extm	High
2.02	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Non-destructive testing on RAS headers - methods that require surface preparation	Pipe internal wall condition not known, surface prep could cause more damage	Un-expected downtime to do corrective action	Defined	2	2	4	CHAIR 1 GENERIC 7	LOAD / FORCE	Mitigation	Try not to do additional prep around welds where issues are more significant.	2	1	2		Low	Low
2.04	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Operation of isolation valves that are not commonly used (size 14" to 36")	Failure of gate, does not seal.	Schedule, cost	Defined	4	3	12	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Mitigation	Replace valves known to be an issue - 20" valves at HPO Inlets	4	1	4		Extm	High
2.05	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	Process unstable	Process upset - TSS issue	Defined	3	4	12	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Mitigate	Maintain primary clarifier capacity, avoid other activity that could increase risk of process upset	3	3	9		High	High

2.06	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	Length of dry season reduced by late rainstorm	Start of construction delayed	Defined	2	3	6	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Accept				0	Med	Not Assessed	
2.07	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	Length of dry season reduced by early snowmelt	Flow exceeds capacity of 2 trains, flow bypassed, exceed compliance	Defined	3	3	9	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Mitigation	Stipulate LD in Bid Opp. good scheduling, contractor risk mitigation plan, include appropriate float in schedule	3	2	6	High	Med	
2.08	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	NEWPCC reduced staff levels mid Dec to mid Jan	No staff to react to emergencies	Defined	2	5	10	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Mitigation	Plan to avoid work requiring staff involvement	1	5	5	High	High	
2.09	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	Prolonged outage could affect other equipment, require additional maintenance	Problems with re-start of equipment or instruments	Defined	3	2	6	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Accept				0	Med	Not Assessed	
2.10	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	Reduced temperature in HPO reactor	Freezing	Defined	1	1	1	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Accept				0	Low	Not Assessed	
2.11	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	Train 1 clarifiers perform best, has highest hydraulic capacity	Less reliable process when Train 1 clarifiers out of service	Defined	2	4	8	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Mitigation	Maintain primary clarifier capacity, avoid other activity that could increase risk of process upset - Operational Planning required to potentially advance clarifier maintenance or push out of window of the work - OVERALL PLANT OUTAGE CONSIDERATIONS - One thing out at a time for reliability. Look at other work going on in the plant.	2	3	6	High	Med	
2.12	2021-03-30	2021-03-26	Construction: Pipe Replacement	O	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	Time to perform extended maintenance	Longer term reliability	Identified			0	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN					0	Not Assessed	Not Assessed	
2.13	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	Need to clean a primary clarifier	Process upset - TSS issue	Defined	2	3	6	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Accept				0	Med	Not Assessed	
2.14	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	Train interconnection valves do not seal, large leak not manageable	Schedule impact	Defined	4	1	4	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Mitigation	Create contingency plan	3	1	3	High	Med	
2.15	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train during 1 season (winter dry season November 15 to March 15)	PE valves at HPO reactor inlet do not seal	Schedule impact	Defined	4	1	4	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Mitigation	Create contingency plan	3	1	3	High	Med	
2.16	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Transporting of large sections of pipe in/out of plant operational area - Limit on craning access etc	Limitation to size of replacement pipe spool and times accessible	Schedule and cost impact	Defined	2	4	8	CHAIR 1 OVERVIEW 8	COMMISSION / START-UP / SHUTDOWN	Transference	Identify constraints in Bid Opp.	2	1	2	High	Low	
2.17	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Transporting of large sections of pipe in/out of plant operational area	Damage to existing equipment or infrastructure	Schedule and cost impact, operational issues	Defined	2	2	4	CHAIR 1 GENERIC 2	SIZE	Transference	Identify constraints in Bid Opp. & make contractor responsible for damage / insurance etc.	2	1	2	Low	Low	
2.18	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Transporting of large sections of pipe in/out of plant operational area	Need to relocate other services or equipment	Schedule and cost impact, operational issues	Defined	2	2	4	CHAIR 1 GENERIC 2	SIZE	Transference	Identify constraints in Bid Opp.	2	1	2	Low	Low	
2.19	2021-03-30	2021-03-26	Construction: Pipe Replacement	T	Planned Shutdown of single RAS train outside of winter dry season November 15 to March 15			Defined	5	5	25	CHAIR 1 GENERIC 2	SIZE	Avoidance				0	Extm	Not Assessed	
2.20		2021-04-19	Construction: Pipe Refurbishment by External Wrapping	T	Removal of sections of pipe	Open pipe exposes workers to process fluid	Injury to workers - infection, biohazard	Identified	4	5	20	CHAIR 1 OVERVIEW 4	TOXICITY	Transference	General contractor to follow CoW guidelines/safe work procedures for work around wastewater hazard.	3	1	3	Serious	Low	
2.21		2021-03-26	Construction: Pipe Replacement	T	Removal and reinstallation of piping loads and unloads connecting pipework	Added stress on pipe and pipe wrap between supports. Damage to pipe creates new leak.	Cracks, deflection in pipe wrap and piping resulting in more leaks	Defined	4	5	20	CHAIR 1 OVERVIEW 4	TOXICITY	Transference	General contractor to follow CoW guidelines/safe work procedures for work around wastewater hazard.	3	1	3	Serious	Low	
2.22		2021-04-19	Construction: Pipe Replacement	T	Removal of sections of pipe	Large and heavy sections of piping to be manipulated	Injury to workers, damage to equipment	Identified	4	5	20	CHAIR 1 GENERIC 2	SIZE	Transference	General contractor to follow CoW guidelines/safe work procedures for work around wastewater hazard.	3	1	3	Serious	Low	
2.23		2021-04-19	Construction: Pipe Replacement	T	Hot work in RAS Gallery	Grinding and welding	Injury to workers, damage to equipment due to heat, sparks	Identified	4	5	20	CHAIR 1 OVERVIEW 5	FIRE / EXPLOSION	Transference	General contractor to follow CoW guidelines/safe work procedures for work around wastewater hazard.	3	1	3	Serious	Low	
2.24		2021-04-19	Construction: Pipe Replacement	T	Hot work in RAS Gallery	Grinding and welding	Injury to workers, damage to equipment due to smoke, fumes	Identified	4	5	20	CHAIR 1 OVERVIEW 4	TOXICITY	Transference	General contractor to follow CoW guidelines/safe work procedures for work around wastewater hazard.	3	1	3	Serious	Low	
3.01		2021-03-26	Construction: Pipe Refurbishment by External Wrapping	O	Minimal shutdown longer than 48 hours required			Identified			0							0	Not Assessed	Not Assessed	
3.02		2021-03-26	Construction: Pipe Refurbishment by External Wrapping	O	Work outside of seasonal restriction			Identified			0								0	Not Assessed	Not Assessed

3.03	2021-03-30	2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	External wrap method	Life expectancy does not match replacement with new pipe	Future repairs within 25 year design life	Defined	5	2	10	CHAIR 1 OVERVIEW 16	DETERIORATION	Mitigation	Design wrap system for 25 years	3	1	3	Extm	Med
3.04	2021-03-30	2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	External wrap method	Need to relocate other services or equipment	Schedule and cost impact, operational issues	Defined	5	5	25	CHAIR 1 GENERIC 4	POSITION / LOCATION	Transference	Identify constraints in Bid Opp.	3	1	3	Extm	Med
3.05	2021-03-30	2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	Need access to valves, flowmeters	Weak spots at flanges or other discontinuities	Future repairs within 25 year design life	Defined	4	3	12	CHAIR 1 OVERVIEW 16	DETERIORATION	Mitigation	Design wrap system with appropriate details for terminating at flanges	3	1	3	Extm	Med
3.06	2021-03-30	2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	External wrap	Need to tap into pipe for future maintenance, creates weak spot	Future repairs within 25 year design life	Defined	2	3	6	CHAIR 1 OVERVIEW 16	DETERIORATION	Accept			0	Med	Not Assessed	
3.07	2021-03-30	2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	Surface preparation of steel pipe to accept wrap	Damage to pipe creates new leak	Compromises quality of wrap	Defined	3	4	12	CHAIR 1 OVERVIEW 16	DETERIORATION	Transference	Wrap provider to determine what level of surface prep required, identify condition of existing piping in Bid-Opp.	3	1	3	High	Med
3.08	2021-03-30	2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	Surface preparation of steel pipe to accept wrap	Damage to pipe creates new leak	Schedule impact due to shutdown and cleanup	Defined	5	4	20	CHAIR 1 OVERVIEW 8	COMMISSION / STARTUP / SHUTDOWN	Transference	Wrap provider to determine what level of surface prep required, identify condition of existing piping in Bid-Opp.	3	1	3	Extm	Med
3.09	2021-03-30	2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	Surface preparation of steel pipe to accept wrap	Damage to pipe creates new leak	Injury to workers - infection, biohazard	Defined	4	5	20	CHAIR 1 OVERVIEW 4	TOXICITY	Transference	Wrap provider to determine what level of surface prep required, identify condition of existing piping in Bid-Opp.	3	1	3	Extm	Med
3.10	2021-03-30	2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	External wrap repair method solvent and other materials	Emission of toxic VOCs	Injury to workers - inhalation, respiratory illness	Defined	5	5	25	CHAIR 1 OVERVIEW 4	TOXICITY	Transference	Ventilation (and heating) requirements identified in Bid Opp.	3	1	3	Extm	Med
3.11	2021-03-30	2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	External wrap repair method solvent and other materials	Fire hazard due to improper storage of flammable liquids or combustible materials	Injury to workers - accidental or uncontrolled ignition and burning, burns	Defined	4	3	12	CHAIR 1 OVERVIEW 5	FIRE / EXPLOSION	Transference	Wrap provider to follow WHMIS requirements for storage and use of controlled products	3	1	3	Extm	Med
3.12		2021-03-26	Construction: Pipe Refurbishment by External Wrapping	T	Limited Crane access	Restricted access	Schedule Delays	Identified	2	1	2						0	Tell the contractor the restriction	Low	Not Assessed
3.13		2021-04-19	Construction: Pipe Refurbishment by External Wrapping	T	Removal and reinstallation of pipe supports loads and unloads connecting pipework.	Added stress on pipe and pipe wrap between supports. Damage to pipe creates new leak.	Cracks, deflection in pipe wrap and piping resulting in more leaks	Identified	4	5	20			Mitigate	Engineer plan to mitigate			0	Extm	Not Assessed
3.14		2021-04-19	Construction	T	Limited structural grating capacity.	Grating Access restrictions being unknown	Failure of Grating	Identified	4	2	8			Mitigate	Include grating limits in tender	2	2	4	High	Low
3.15		2021-04-19	Construction	T	Limited structural grating capacity.	Grating Access restrictions being Applied	Sequencing delays	Identified	3	3	9			Transfer	Include grating limits in tender	1	1	1	High	Low
3.15		2021-04-19	Construction	T	Limited structural grating capacity.	Grating Access restrictions being Applied	Access Issues	Identified	3	3	9			Transfer	Include grating limits in tender	1	1	1	High	Low
3.16					Equipment in a limited space	Access to Egress could be compromised	Poor Coordination of Activity	Identified	2	5	10			Transference	Frequent Egress Plan Updates	2	2	4	High	Low
3.17					Equipment in a limited space	Access for testing could be restricted	Lab Testing Issues	Identified	4	4	16			Mitigate	Integrate access into the RFP (KGS Action)	1	1	1	Extm	Low
3.18					Equipment in a limited space	Access for regular Travel could impeded	Inconvenience	Identified	1	4	4			Accept			0	Med	Not Assessed	
3.18					Equipment in a limited space	Access for regular Travel could impeded	Inability or limited ability to perform normal checking	Identified			0						0	Not Assesie	Not Assessed	
3.18					Equipment in a limited space	could disrupt maintenance activities	Plant Impacts	Identified	4	4	16			Mitigate	Integrate access into the RFP (KGS Action) - Clarify with equipment sizes	1	1	1	Extm	Low
3.18					Equipment in a limited space	change in egress patterns	poorer access to egress for CoW Staff	Identified	3	4	12				Integrate access PLANS into the RFP (KGS Action)	1	1	1	High	Low
3.18					Equipment in a limited space	Blocking multiple egress paths	Failure to maintain proper Egress	Identified	3	4	12				Integrate access PLANS into the RFP (KGS Action)	1	1	1	High	Low
3.18					Extended Work Time or City Support requirements	Higher requirements for staff participation	Insufficient staff available.	Identified	3	5	15			Mitigate	Define access to staff for contractor, and put schedule delays for access to staff in their risk, not the City Costs. - Normal mitigations	2	2	4	Extm	Low

3.18					Fouled Air - Construction	Issues with air quality / toxicity for workers	Resulting in toxic atmosphere		5	5	25			Transference	KGS To take away review of ventilation to transfer a safe working plan to contractual requirements	1	4	4		Extm	Med
3.18					Danger of smoke - After construction						0							0		Not Assesse	Not Assessed
3.18				T	Poor information	Premature failure of the system	Compromising the piping				0			Mitigation	Ensure proper O&M info for the long term maintenance is provided by the contractor - UP FRONT if possible			0		Not Assesse	Not Assessed
3.18					Poor QA/ QC	System could be failure prone	Compromising the piping				0	Chair 1. Overview 14	QUALITY CONTROL	Mitigation	Ensure detailed over-site and inspection (3rd Party) plus full QA Checks on inspection, and some ability to halt work if not followed.			0		Not Assesse	Not Assessed
3.18					Poor Maintenance by the City	System could be failure prone	Compromising the piping				0	Chair 1. Overview 14	QUALITY CONTROL	Accept	Ensure there is a PM Program in place			0		Not Assesse	Not Assessed
3.18					Poor QA/ QC	Poor records	Making it difficult to make the warranty claim in future				0	Chair 1. Overview 14	QUALITY CONTROL	Mitigation	Ensure detailed over-site and inspection (3rd Party) plus full QA Checks on inspection, and some ability to halt work if not followed.			0		Not Assesse	Not Assessed
3.18					Failure in bonding at the termination point	Seepage from the pipe repair	A leak needing immediate repair.		2	2	4	Chair 1. Overview 14	QUALITY CONTROL	Mitigation	Ensure there is a process to deal with this in the O&M	2	2	4		Low	Low

### Assessment of the Magnitude of Opportunity

	Insignificant Savings	Minor Savings	Moderate Savings	Major Savings	Significant Savings
	1	2	3	4	5
Cost <sup>1</sup>	< 2% of Project Budget <sup>2</sup>	< 5% of Project Budget <sup>2</sup>	< 10% of Project Budget <sup>2</sup>	< 15% of Project Budget <sup>2</sup>	> 20% of Project Budget <sup>2</sup>
Time <sup>2</sup>	Time savings <½ day	Time savings ½ – 1 day	Time savings >1 day, < 1 week	Time savings >1 week, < 1 month	Time savings >1 month
Other <sup>4</sup>					
<b>Notes</b> 1 - Project Manager to replace with project specific values 2 - Use Target Cost where the project is subject to a Target Cost 3 - Replace with project specific values 4 - To be defined by the Project Manager if required					

### Assessment of the Magnitude of Threat

Descriptor	Negligible	Moderate	Substantial	Severe	Disastrous
	Small effect on costs	Moderately effects costs	Considerably affects cost	Serious threat to the organization, public etc.	The impact is totally unacceptable to the organization
	1	2	3	4	5
Safety	Negligible – No injury, near miss	Minor – minor cuts, bruises, muscle strain	Serious – broken bones, muscle and ligament injuries	Serious / permanent injury / illness	Catastrophic – Single or Multiple fatalities
Financial Impact upto a maximum value (re-work / loss etc..) <sup>1</sup>	< 2% of Project Budget <sup>2</sup>	< 5% of Project Budget <sup>2</sup>	< 10% of Project Budget <sup>2</sup>	< 15% of Project Budget <sup>2</sup>	> 20% of Project Budget <sup>2</sup>
Schedule, impact on critical path <sup>2</sup>	Not likely to impact dates	Likely to absorb float between planned dates and target dates	≤ 1 month	≤ 2 month	> 2 month
Environment	Negligible Environmental effect	Nuisance / minor but reversible Environmental harm	Moderate but short term Environmental harm	Localised, long term Environmental harm	Extensive long term Environmental harm
Regulatory	negligible, near miss	report required to regulatory body	Inspection by Manitoba Env safety officer etc..	CEC review	Clean Environment Commission (CEC) Hearing
Image / Reputation	Single Public Enquiry	Multiple Public Enquiries and / or informal Councillor and / or MP Request	Moderate Media Political – Formal Council and / or MP Request / Moderate Public Impact	Provincial Government, Major Political & Media Scrutiny / Major Public Impact	Federal Investigation
Moral	No Impact	Grumbings at wter cooler	Moderate / Increasing Absenteeism	Major Negative / Loss of Staff / "Go Slow"	Catastrophic Negative / walk out
Legal	No Liability	Written Claim Damages < \$10,000	Damages > \$10,000 < \$250,000	Damages >\$250,000 < \$1,000,000	Damages >\$1,000,000
Other <sup>4</sup>					

**Notes**  
 1 - Project Manager to replace with project specific values  
 2 - Use Target Cost where the project is subject to a Target Cost  
 3 - Replace with project specific values  
 4 - To be defined by the Project Manager if required

## Assessing Likelihood/probability of Risk Occurrence

Descriptor	Rating	Frequency	Probability
Almost certain	5	Is expected to occur during projects of this type	> 95%
Likely	4	More likely as not, regularly occurs during projects of this type	60% < x < 95%
Moderate	3	As likely as not, might occur at sometime during a project of this type	30% < x < 60%
Unlikely	2	Could occur at some time during the project, rarely occurs on projects of this type	5% < x < 30%
Rare	1	Only occur in exceptional circumstances on projects of this type	< 5%

### Note on the use of Specific Probability Data and Distributions:

The first step in assessing the likelihood / probability of a risk should always be to apply the project teams engineering judgement and experience, in most cases this approach is all that is required. Specific probability data is available from a variety of sources, however unless the assumptions underpinning such distributions and data hold, the results can be misleading and introduce greater risk. Such data should be checked carefully before it is used.

<b><i>Total Severity</i></b>	<b><i>Category</i></b>	<b><i>Response</i></b>
20-25	Critical	Expected cost to the project is unacceptably high. This risk must be eliminated or transferred before proceeding with the project.  Attempt to avoid or transfer risk
10-20	Serious	Expected cost is high compared to total project cost. It probably is cost effective to eliminate or transfer this risk.
5-10	Important	Consider eliminating or transferring. If accept then manage proactively.
0-5	Acceptable	Accept and manage

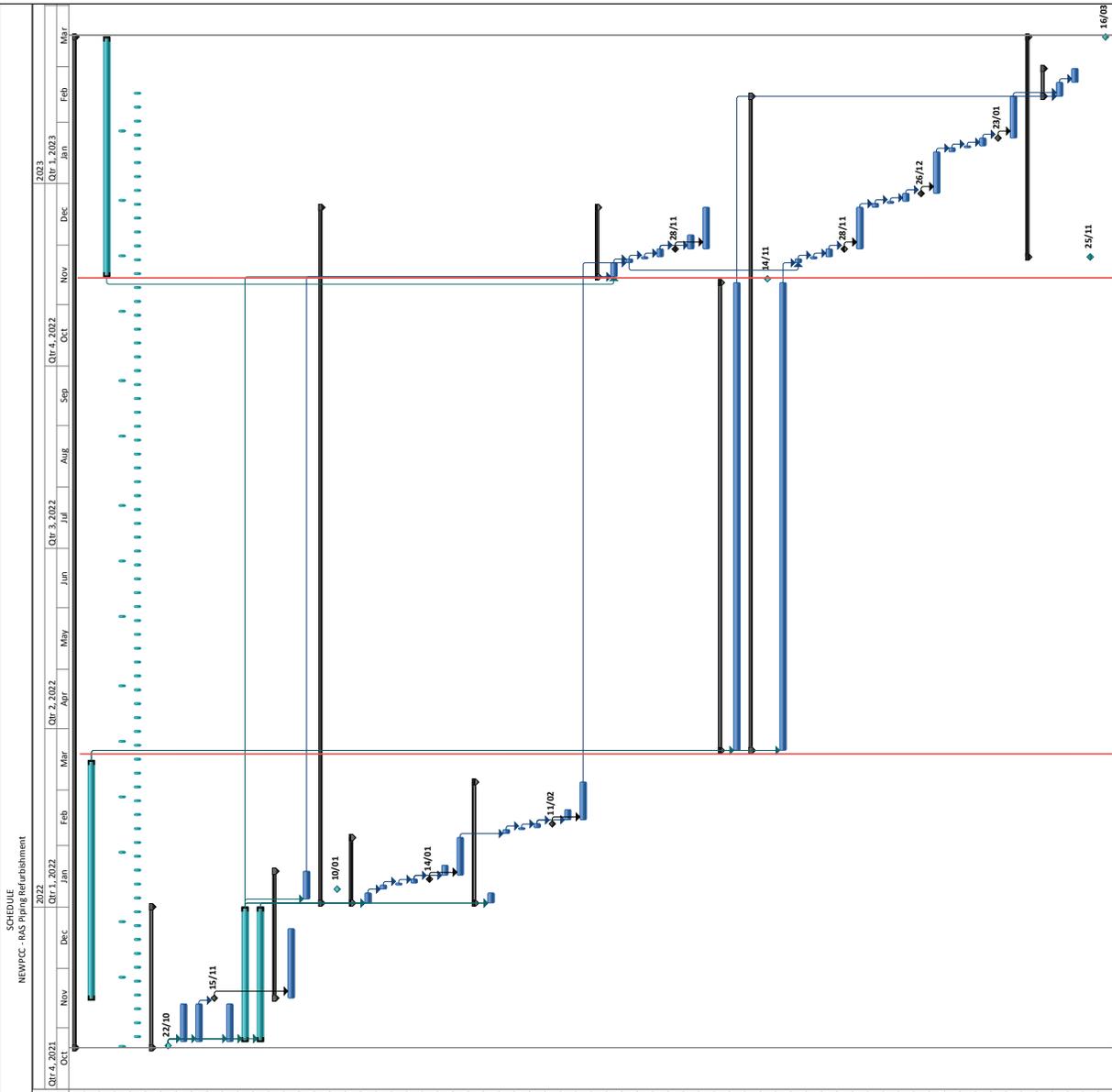
**SUMMARY - CHAIR 1 - STUDY GUIDEWORDS - GENERIC and OVERVIEW**

CARD NUMBER	GUIDEWORD	SUB-PROMPTS
Chair 1. Generic 2	SIZE	Too large Too small Too long Too short Too wide Too narrow
Chair 1. Generic 3	HEIGHTS / DEPTHS	Working at heights Falls / struck by falling objects Scaffolding (shape, space to fit) Confined space <del>Access / Egress</del>
Chair 1. Generic 4	POSITION / LOCATION	Too high Too low Too far Misaligned <del>Wrong position</del>
Chair 1. Generic 5	POOR ERGONOMICS	Posture / manual handling RSI / discomfort / fatigue / stress Effect on PPE Visibility (lighting sightlines) <del>Climb time falls</del>
Chair 1. Generic 6	MOVEMENT / DIRECTION	Stability Compression Physical damage Vibration Friction / slip Rotation Upwards / Downwards Reverse <del>Excessive / Tension Belayers</del>
Chair 1. Generic 7	LOAD / FORCE	High / Excess Low insufficient Additional loads (construction) Dynamics <del>Temporary Weakness</del>
Chair 1. Generic 8	ENERGY	Low / high energy Tension / compression Potential / kinetic Inertia / moment
Chair 1. Generic 9	TIMING	Too late, too early Too short, too long Incorrect sequence Extended delays
Chair 1. Generic 10	EGRESS / ACCESS	No. of exit points Emergency egress, size Obstructions, lighting Entry / exit points External Impacts Maintenance <del>People and Equipment Movements</del>
Chair 1. Generic 11	MAINTENANCE / REPAIR	Posture / Manual Handling Size / Width Access / Egress Heights / Dropped Objects Weight Discomfort / Stress / PPE Visibility / Slips / Trips Rotating Equipment
Chair 1. Overview 2	ENVIRONMENTAL CONDITIONS	Extreme Weather Temperature Ground Noise <del>Water</del>
Chair 1. Overview 3	EXTERNAL SAFETY INTERFACES	Members of the public Traffic Adjacent Property Power / services <del>External fire / plans Day / night / weekend</del>
Chair 1. Overview 4	TOXICITY	Lead / Asbestos Handling Precautions <del>Ventilation</del>
Chair 1. Overview 5	FIRE / EXPLOSION	Prevention / detection Fire protection <del>Emergency procedures</del>
Chair 1. Overview 6	ENVIRONMENTAL IMPACT	Vapour / dust Effluent / Noise Seepage / Waste
Chair 1. Overview 7	UTILITIES & SERVICES	Lighting Air / Water <del>Fuel / Electricity Oxygen / Water</del>
Chair 1. Overview 8	COMMISSION / STARTUP / SHUTDOWN	Requirements Sequence
Chair 1. Overview 9	SAFETY EQUIPMENT	Personnel Protection Safety Showers <del>Barriers / Guards</del>
Chair 1. Overview 10	NATURAL HAZARDS	Earthquake Flooding Thunderstorm (lightning protection) <del>High Winds</del>
Chair 1. Overview 11	INSPECTION / TESTING	Eliminating Isolation <del>Access</del>
Chair 1. Overview 12	DEMOLITION	Ease Issues <del>Documentation</del>
Chair 1. Overview 13	DOCUMENTATION	Operations Maintenance Inspection / Testing Sequence Emergency <del>Records / Reports</del>
Chair 1. Overview 14	QUALITY CONTROL	Inspection / Testing Quality Assurance
Chair 1. Overview 15	CONSTRUCTION EQUIPMENT	Sequence Timing, Access
Chair 1. Overview 16	DETERIORATION	Age, wall thinning, failure to meet original design due to degradation, unknown condition

# **APPENDIX C**

Project Schedule

NEWPCC - RAS Piping Refurbishment



ID	Task Name	Start	Finish	Duration
1	<b>CONSTRUCTION SCHEDULE</b>	<b>Fri 22/10/21</b>	<b>Thu 16/03/23</b>	<b>72.8 wks</b>
2	Low Flow Period 1	Mon 15/11/21	Tue 15/03/22	17.4 wks
3	Low Flow Period 2	Tue 15/11/22	Wed 15/03/23	17.4 wks
4	<b>Monthly Meetings</b>	<b>Fri 27/10/21</b>	<b>Fri 27/10/23</b>	<b>66.2 wks</b>
21	<b>Weekly 3rd Party Inspection</b>	<b>Wed 17/10/21</b>	<b>Wed 15/02/23</b>	<b>68.2 wks</b>
91	<b>PROJECT START-UP</b>	<b>Fri 22/10/21</b>	<b>Fri 31/12/21</b>	<b>10.2 wks</b>
92	Construction Contract Awarded	Fri 22/10/21	Fri 22/10/21	0.2 wks
93	Document Review	Mon 25/10/21	Fri 12/11/21	3 wks
94	Build and Test Three Mock-Up Test Spools - Offsite	Mon 25/10/21	Fri 12/11/21	0.2 wks
95	Issue Test Report	Mon 25/10/21	Fri 12/11/21	0.2 wks
96	Mobilisation to Site	Mon 25/10/21	Fri 12/11/21	15 days
97	Valve Procurement	Mon 25/10/21	Fri 12/11/21	10 wks
98	Flow Meter Procurement	Mon 25/10/21	Fri 12/11/21	10 wks
99	<b>EARLY CONSTRUCTION WORKS</b>	<b>Tue 16/11/21</b>	<b>Tue 16/03/22</b>	<b>9.2 wks</b>
100	Apply Repair System to Selected Locations (concurrent at multiple locations)	Mon 20/12/21	Mon 20/12/21	25 days
101	Install New UPS and UPS's on RAS Trains 1/2/3 - Hot Tapping	Wed 09/01/22	Tue 15/03/22	10 days
102	<b>RAS PIPE REPLACEMENT WORKS</b>	<b>Mon 09/01/22</b>	<b>Mon 19/12/22</b>	<b>50.2 wks</b>
103	RAS System Pre-Commissioning Meeting	Mon 10/01/22	Mon 10/01/22	0 days
104	Pipe, Valve and Meter Replacement - RAS Train No.3	Mon 09/01/22	Fri 04/02/22	5 wks
105	Stage and Assemble Spool Pieces, Set-Up Access/Rigging	Mon 09/01/22	Fri 04/02/22	2 days
106	Replacement of DN650 pipe spools, Isolation Gate Valves, and Flowmeters	Wed 12/01/22	Wed 12/01/22	1 day
107	RAS Train No.3 Shut-Down and Partial Draining of Header and HPO Tank	Thu 13/01/22	Fri 14/01/22	2 days
108	Commission RAS Train No.3 valves, and flowmeter	Fri 14/01/22	Fri 14/01/22	0 days
109	Remove Access, Cleanup/Teardown	Mon 17/01/22	Fri 21/01/22	1 wk
110	Performance Verification	Mon 17/01/22	Fri 21/01/22	15 days
111	Pipe, Valve and Meter Replacement - RAS Train No.2	Mon 03/01/22	Fri 04/03/22	9 wks
112	Stage and Assemble Spool Pieces, Set-Up Access/Rigging	Mon 03/01/22	Fri 04/03/22	2 days
113	Replacement of DN650 pipe spools, Isolation Gate Valves, and Flowmeters	Mon 07/02/22	Tue 08/02/22	2 days
114	RAS Train No.2 Shut-Down and Partial Draining of Header and HPO Tank	Thu 10/02/22	Fri 11/02/22	2 days
115	Commission RAS Train No.2 valves, and flowmeter	Mon 14/02/22	Fri 18/02/22	1 wk
116	Remove Access, Cleanup/Teardown	Tue 15/11/22	Mon 19/12/22	5 wks
117	Performance Verification	Tue 15/11/22	Mon 19/12/22	5 wks
118	Pipe, Valve and Meter Replacement - RAS Train No.1	Tue 15/11/22	Mon 19/12/22	5 wks
119	Stage and Assemble Spool Pieces, Set-Up Access/Rigging	Tue 15/11/22	Mon 19/12/22	1 wk
120	Replacement of DN650 pipe spools, Isolation Gate Valves, and Flowmeters	Tue 22/11/22	Wed 23/11/22	2 days
121	RAS Train No.1 Shut-Down and Partial Draining of Header and HPO Tank	Fri 25/11/22	Mon 28/11/22	2 days
122	Commission RAS Train No.1 valves, and flowmeter	Mon 28/11/22	Mon 28/11/22	0 days
123	Remove Access, Cleanup/Teardown	Tue 29/11/22	Mon 05/12/22	1 wk
124	Performance Verification	Tue 29/11/22	Mon 05/12/22	1 wk
125	<b>SYSTEM WIDE CFRP WRAP AND RELATED WORKS INCL. PIPE SUPPORTS, FLANGE TERMINATION SLEEVE</b>	<b>Mon 21/03/22</b>	<b>Mon 19/12/22</b>	<b>15 days</b>
126	System Wide CFRP Wrap	Mon 21/03/22	Fri 11/11/22	34 wks
127	WAS System Pre-Commissioning Meeting	Mon 14/11/22	Mon 14/11/22	0 days
128	Install New WAS Pipe	Mon 21/03/22	Mon 14/11/22	34 wks
129	Shut-Down and Drain WAS Header No.1	Tue 22/11/22	Wed 23/11/22	2 days
130	Re-Fill and Start WAS Header No.1	Thu 24/11/22	Thu 24/11/22	1 day
131	Commission WAS Train No.3 pumps, valves, and flowmeter	Fri 25/11/22	Mon 28/11/22	2 days
132	Performance Verification	Mon 28/11/22	Mon 28/11/22	0 days
133	Shut-Down and Drain WAS Header No.2	Tue 29/11/22	Mon 19/12/22	15 days
134	Re-Fill and Start WAS Header No.2	Tue 29/11/22	Mon 19/12/22	15 days
135	Commission WAS Train No.2 pumps, valves, and flowmeter	Tue 29/11/22	Mon 19/12/22	15 days
136	Performance Verification	Tue 29/11/22	Mon 19/12/22	15 days
137	Shut-Down and Drain WAS Header No.3	Fri 25/11/22	Mon 28/11/22	2 days
138	Re-Fill and Start WAS Header No.3	Thu 19/01/23	Thu 19/01/23	1 day
139	Commission WAS Train No.1 pumps, valves, and flowmeter	Mon 23/01/23	Mon 23/01/23	0 days
140	Performance Verification	Tue 24/01/23	Mon 13/02/23	15 days
141	<b>PROJECT CLOSEOUT</b>	<b>Fri 25/11/22</b>	<b>Mon 27/02/23</b>	<b>15.8 wks</b>
142	Relocate Electrical, Teardown Interior Staging	Tue 14/02/23	Mon 20/02/23	1 wk
143	Teardown Exterior, Laydown and Storage	Tue 14/02/23	Mon 20/02/23	5 days
144	Certificate of Substantial Performance	Fri 25/11/22	Fri 25/11/22	0 days
145	Certificate of Total Performance	Thu 16/03/23	Fri 16/03/23	0 days

# **APPENDIX D**

Sequence of Work

**TENDER 538-2021: CONSTRUCTION PLAN - APPENDIX D  
NEWPCC RAS PIPING REFURBISHMENT SEQUENCE OF WORK**

#	TASK
<b>001</b>	<b>Build and Test Mock-Up Test Spools</b>
002	Fabricate mock-up test spools
003	Apply proposed repair system to fabricated spool
004	Inspect composite wrap for defects
005	Pressure test spool and wrap
006	Inspect composite wrap for leaks
007	Repeat steps 002 - 006 until 3 succesful tests have been performed
<b>010</b>	<b>Procurement and Documentation Review</b>
011	Purchase Manual Isolation Valves
012	Issue Composite Wrap Design Drawings and Details
<b>100</b>	<b>Mobilisation to Site</b>
101	Set-up safety signage and access control
102	Set-up exterior laydown area
103	Set-up environmentally controlled storage
104	Set-up forced air ventilation for RAS gallery
105	Shut-down existing RAS gallery ventilation system
106	Set-up interior staging area
107	Temporarily relocate electrical cables for access
<b>200</b>	<b>Apply Repair System to Selected Locations</b>
201	Build access/enclosure for sections to be repaired
202	Remove lead paint from surface, dispose of toxic products
203	Perform ultrasonic thickness testing of substrate
204	Prepare exterior surface of pipe (substrate) to accept the repair system
205	Apply filler material to areas with leaks, cracks, holes
206	Prepare galvanic protection layer FRP products (primer, fabric, wet-out)
207	Apply galvanic protection layer primer
208	Apply galvanic protection layer saturated fabric
209	Prepare CFRP repair system products (primer, fabric, wet-out)
210	Apply CFRP repair system layer primer
211	Apply CFRP repair system layer saturated fabric
212	Repeat above step until required thickness is achieved
213	Apply fire resistant top-coat
214	Cure repair system and top coat
215	Perform hardness test on cured wrap
216	Visually inspect repair integrity/adhesion
217	Repair any defects observed during inspection
218	Remove scaffolding/access
219	Repeat Section 200 for all selected locations
<b>300</b>	<b>Pipe, Valve and Meter Replacement</b>
301	Stage new component assembly on far West side of HPO tank pipe gallery
302	Fully assemble new manual valve, new flowmeter, and new straight pipe section
303	Build access/enclosure around old piping to be replaced
304	Set up rigging for temporary support and lifting of old section to be replaced
305	City to Shut down RAS train
306	City to Drain RAS train below invert of connecting large diameter tee fitting
307	Disconnect modulating ball valve pneumatic tubing

308	Isolate section to be replaced and open low point drain
309	Unbolt or grind off bolted/welded connections to supports
310	Unbolt flanges to connecting pipework, capture spills from open flange
311	Lift spool off supports and place on adjacent dolly
312	Unbolt and transfer existing modulating ball valve over to new spool and bolt-up
313	Wrap old spool, meter, and valve assembly and loose elbow fitting for disposal
314	Roll new spool with original ball valve into position adjacent to work area and rig for lift
315	Lift new spool onto supports and check alignment
316	Bolt-up flanged connections
317	Bolt or weld support connections
318	Re-connect ball valve pneumatic tubing
319	Connect wiring from new flowmeter to transmitter
320	Verify flanged openings and valve are sealed water-tight
321	City to refill RAS train, and restart system
322	Remove scaffolding/access
323	Commission valves and flowmeter
324	Repeat Section 300 for RAS trains 1, 2, and 3
<b>400 Install new support anchor bolts and grout pads</b>	
401	Survey new support locations
402	Install anchor bolts
403	Build grout forms
404	Apply grout and cure
405	Inspect grout pads and anchors
406	Apply coating
<b>425 Install new LPD and HPVs</b>	
426	Test existing LPD and HPV valves for operation
427	Hot tap new vent and drain points
<b>500 System Wide CFRP Wrap</b>	
501	Build access/enclosure for applicable length of to be repaired
502	Remove lead paint from surface at terminations, dispose of toxic products
503	Perform ultrasonic thickness testing of substrate at terminations
504	Prepare exterior surface of pipe (substrate) to accept the repair system
505	Apply filler material to areas with leaks, cracks, holes
506	Prepare galvanic protection layer FRP products (primer, fabric, wet-out)
507	Apply galvanic protection layer primer
508	Apply galvanic protection layer saturated fabric
509	Prepare CFRP repair system products (primer, fabric, wet-out)
510	Apply CFRP repair system layer primer
511	Apply CFRP repair system layer saturated fabric
512	Repeat above step until required thickness is achieved
513	Apply CFRP repair to fittings, valves, flanges etc.
514	Apply fire resistant top-coat
515	Cure repair system and top coat
516	Perform hardness test on cured wrap
517	Visually inspect repair integrity/adhesion
518	Repair any defects observed during inspection
519	Align and fit-up new prefabricated pipe support(s)
520	Bolt-up/weld new pipe support(s)
521	Cut/remove existing pipe support(s)
522	Remove scaffolding/access
523	Repeat Section 500 for full length of system
524	Repeat above step for all three RAS trains

<b>600</b>	<b>Demobilisation</b>
601	Return electrical cabling to original state
602	Teardown staging and temporary ventilation
603	Restart RAS gallery ventilation
604	Teardown exterior laydown and storage
605	Remove safety signage, access control

**KGS**  
GROUP

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Experience in Action

**APPENDIX E – COMMISSIONING PLAN**

**CITY OF WINNIPEG**

Tender No.: 538-2021

NON-METALLIC COMPOSITE REPAIR SYSTEM FOR NEWPCC  
RAS PIPING SYSTEM REFURBISHMENT

## Commissioning Plan - FINAL

Final:

Rev 0

Date:

September 15, 2021

KGS Group Project:

21-0107-001



2021-09-15

PREPARED BY:

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## 1.0 COMMISSIONING PLAN OVERVIEW

The North End Sewage Treatment Plant (NEWPCC) is the largest of three sewage treatment plants servicing the City of Winnipeg. The Return Activated Sludge (RAS) piping system conveys effluent from the Secondary Clarifiers to the High Purity Oxygen (HPO) tanks. The trunk pipework of the system consists of approximately 600 meters of pipe, ranging from 300 millimeters to 900 millimeters in diameter, and many valves, flowmeters, and pumps. Reliable operation of the RAS piping system is critical to the operation of the plant. However, the RAS piping system, installed in the late 1980s, is beyond its design service life and several leaks have started.

A minimum extended piping design life of twenty-five years is conservatively sufficient to cover the remaining service life of RAS piping system. This project was conceived as part of the Water and Waste Asset Refurbishment and Replacement Program for repair or replacement of the piping to mitigate risk of further deterioration, and to restore the system to a condition that can provide that minimum service life.

The following document provides information for the start-up, testing, operation and acceptance criteria for the commissioning of new equipment on the RAS system Refurbishment Project. These include the following:

- Descriptions of start-up, pre-commissioning, commissioning, and performance verification activities.
- List of the applicable checklists and test records
- Requirements for the post-construction training of the City plant operations staff
- Requirements for the operations and maintenance documents

Generally, the effort required for commissioning is anticipated to be small, due to the lack of changes to the existing equipment and will occur at various stages throughout the project. For scheduling and workflow reasons, commissioning will not be reserved for the end of the project as is typically done on other refurbishments.

### 1.1 Participants

Commissioning will require the participation of the following organizations to verify the performance of the equipment and systems:

- Contractor and any applicable Subcontractors.
- Original Equipment Manufacturer (OEM) – Transwest.
- Contract Administrator – KGS Group.
- City of Winnipeg.

## 1.2 Roles and Responsibilities

The Contract Administrator is to provide comprehensive planning and leadership for the commissioning of the works and is responsible for ensuring that all commissioning activities are carried out to allow for the delivery of a fully operational facility that is compliant and complete. The Contract Administrator will provide sufficient personnel to develop, manage and implement the commissioning works as illustrated by Table 1 below.

**TABLE 1**  
**ROLES AND RESPONSIBILITIES**

Item	Task Description	Organisation	Responsibility	
			Department (If Applicable)	Individual (If Applicable)
1	Safely perform all pre-commissioning, commissioning and performance verification activities.	Contractor		
2	Safely operate the equipment as required to perform commissioning activities	Contractor		
3	Document equipment and control system settings.	Contractor		
4	Provide operations and maintenance manuals.	General Contractor		
5	Provide as-built drawings.	Contractor		
6	Schedule and coordinate commissioning works.	Contract Administrator	PM	Prasan S.
7	Prepare agenda and record minutes of commissioning meetings.	Contract Administrator	PM	Prasan S.
8	Track deficiencies, record corrective measures	Contract Administrator	MECH ELEC	Colburn H. Tim B. Jon W.
9	Supply commissioning record sheets, test forms, and other documentation.	Contract Administrator	MECH ELEC	Colburn H. Tim B. Jon W.
12	Review and approve commissioning handover package.	Contract Administrator	MECH ELEC	Colburn H. Dustin W. Jon W.
13	Start-up and shut down the clarifiers as required for the commissioning work	The City		

Item	Task Description	Organisation	Responsibility	
			Department (If Applicable)	Individual (If Applicable)
14	Apply and remove safety lockouts as required	The City		
15	Verify existing DSC interface to new PLC	The City		
16	Monitor alarms during performance verification.	The City		

### 1.3 Schedule

The anticipated commissioning schedule will occur as described in the most recent revision of the project schedule located in Appendix A. (Note: The project schedule has been trimmed to show only commissioning related tasks.)

Pre-commissioning and start-up tasks will be started prior to the shut-down in order to allow for the minimum amount of down time for the system.

After the completion of shut-down there is a two working day period of time to allow for installation checks, system start-up, and commissioning. The RAS system will be in full operation for the duration of the performance verification, and so training to operate the system controls will be required beforehand. The City has indicated that fifteen days should be allowed for performance verification before proceeding with the shutdown of the next RAS train.

## 2.0 COMMISSIONING REQUIREMENTS

Commissioning of each of the new RAS flow meters will occur independently after each RAS train is shut down. Commissioning of the new flowmeters shall consist of the following:

- Loop wiring checks.
- Instrument calibration.
- Verification that range specified in plant DCS matches range of the flow transmitter.
- Verification of read-out on plant DCS (0%, 50%, and 100% signal).

Like the RAS flow meters, commissioning of the new WAS flow meters will occur after each WAS header tie-in is complete. A shut-down of the RAS train will not be required for the tie-in.

### 2.1 Specifications

The general commissioning specifications applicable to the refurbishment works are as follows:

1. The Contractor shall submit completed testing and field commissioning record sheets on which the results of the various checks and tests shall be recorded, dated, and approved by the OEM and/or installation Subcontractor and the Contract Administrator. Commissioning record sheets are contained in Appendix B.
2. The full extents of the scope of equipment to be tested is as shown in the instrument condition assessment document. The equipment to be commissioned is listed as “replace”. See Appendix C.
3. The Contractor shall advise the Contract Administrator and the City in writing when the work may be inspected before proceeding with the next commissioning task. The equipment and systems shall not be started before the approval of the Contract Administrator has been obtained.
4. The Contractor is responsible for providing the necessary tools, materials, and equipment for conducting the required tests.
5. Any defects which become evident during commissioning shall be immediately corrected at the Contractor’s expense and the test repeated until the work is proven satisfactory.
6. Testing, at a minimum, shall prove the following:
  - a. Control devices operate correctly and satisfactorily.
  - b. All circuits, controls and interlock sequences of operation are correct.
  - c. All protective and indicating devices operate satisfactorily.
  - d. Motor running currents under no load (decoupled motor) and full load are within acceptable ranges.
7. The Contractor is responsible for submitting the Operation and Maintenance (O&M) Manuals in accordance with the technical specifications.

8. Upon total completion of the project the final hand-over package shall be submitted by the Contractor to the Contract Administrator. It shall include all as-built drawings, installation records, and commissioning records.
9. Upon completion of Performance Verification, the Contractor shall submit:
  - Completed form CD-PM-TO-16 Certificate of Equipment Satisfactory Performance Form 103 (see Appendix B).
  - Complete form CD-PM-TO-17 Certificate of Satisfactory Process Performance Form 104 (see Appendix B).

The detailed commissioning tasks are detailed below. For each of the tasks, detailed procedure and record sheets will be provided or developed to document the commissioning of the flow meters. The Contract Administrator will monitor the commissioning activities as specified in Section 2.0; and upon satisfactory completion of the commissioning, will review the documentation provided by the Contractor. The Contractor shall be responsible for the commissioning work under the direction of the Contract Administrator.

## 2.2 Electrical Commissioning Works

### 2.2.1 PRE-COMMISSIONING

1. Perform loop wiring checks for each flow meter as outlined in Appendix C.
2. Perform instrument calibration for each flow meter as outlined in Appendix C.
3. Verify that all motors (if disconnected to accommodate pipe refurbishment work) operate as required in both automatic and manual modes once reconnected.
4. Verify that all power feeders (if disconnected to accommodate pipe refurbishment work) are installed and that the disconnect switches are operational.

### 2.2.2 COMMISSIONING TASKS

1. Verify that range specified in plant DCS matches range of the flow transmitter for each instrument as outlined in Appendix B.
2. Verification of flow read-out on plant DCS for 0%, 50%, and 100% signals for each instrument as outlined in Appendix B.

### 2.2.3 PERFORMANCE VERIFICATION

1. Verify the flowmeters as outlined in Appendix C are functioning as intended during normal plant operations.
  - Complete form CD-PM-TO-16 Certificate of Equipment Satisfactory Performance Form 103 see Appendix B).
  - Complete form CD-PM-TO-17 Certificate of Satisfactory Process Performance Form 104 (see Appendix B).

Refer to Appendix B for relevant City of Winnipeg Electrical Checklists to be employed during commissioning. Any forms not provided that are necessary to show completion of the tasks described shall be developed by the Contractor in an organized fashion, in a computer-generated format.

### 3.0 TRAINING SESSIONS

The objectives of the training are to provide City personnel with the following information:

1. A detailed description of the extent of structural, electrical, and mechanical work done RAS piping system during and after the shut-down period.
2. Recommended preventative maintenance practices along with diagnosis and trouble-shooting information.
3. A review of O&M Manual documentation

At the beginning of the wrap installation, the FRP Installer shall provide one full 8hr day (1/2 day classroom, 1/2 day field instruction) onsite inspection training course with personnel from City and the Contract Administrator. This training will be separate from the preventative maintenance training provided at the end of the project. It will include an overall description of the installation process, and inspection requirements for surface preparation and completed composite wrap.

After substantial completion, the General Contractor will arrange for two in-person classroom instruction sessions for general project information, and specific training for the operation and preventative maintenance of the new flow meters. The training will include input from subcontractors and equipment suppliers, including the OEMs of the new flowmeters and isolation valves. The General Contractor is responsible for the coordination, quality assurance, overall packaging and presentation of two one-hour classroom sessions to provide training to two groups of City personnel. The training will include presentation material and be followed up with an on-site review of the installed equipment.

Additionally, the FRP Installer shall provide a minimum one full day onsite formal training session to instruct City staff to perform small repairs and other preventative maintenance measures. Training shall include step by step repair instructions, product names, and product distributors to perform the repair. This is to be scheduled at a mutually acceptable date for the FRP Installer, Contract Administrator, and City Staff.

The City is responsible for providing appropriate personnel to participate in the training for the operation and maintenance of the facility. All training materials are to be in an acceptable digital format to the City that permits future training procedures that provide the same degree of detail.

## 4.0 O&M MANUAL

Final review and approval of all training manuals and materials is required by the City prior to the training sessions. Submission of the O&M Manual must be within a 2-week period after Substantial Completion. Recommended Preventative Maintenance procedures shall be provided by the OEM and Contractor in document format prior to Substantial Completion. Training materials in general will include the following:

1. "As-Built" contract documents
2. Operating Manuals
3. Maintenance Manuals
4. Shop Drawings
5. Product Information (PI) sheets
6. Supplemental training materials like presentations, training videos and/or equipment models
7. Video recording of training sessions

# **APPENDIX A**

Commissioning Schedule

SCHEDULE  
NEWPCC - RAS Piping Refurbishment

ID	Task Name	Start	Finish	Duration	2022												2023					
					Qtr 4, 2021			Qtr 1, 2022			Qtr 2, 2022			Qtr 3, 2022			Qtr 4, 2022			Qtr 1, 2023		
					Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
1	<b>CONSTRUCTION SCHEDULE</b>	<b>Fri 22/10/21</b>	<b>Thu 16/03/23</b>	<b>72.8 wks</b>																		
2	Low Flow Period 1	Mon 15/11/21	Tue 15/03/22	17.4 wks																		
3	Low Flow Period 2	Tue 15/11/22	Wed 15/03/23	17.4 wks																		
91	<b>PROJECT START-UP</b>	<b>Fri 22/10/21</b>	<b>Fri 31/12/21</b>	<b>10.2 wks</b>																		
99	<b>EARLY CONSTRUCTION WORKS</b>	<b>Tue 16/11/21</b>	<b>Tue 18/01/22</b>	<b>9.2 wks</b>																		
102	<b>RAS PIPE REPLACEMENT WORKS</b>	<b>Mon 03/01/22</b>	<b>Mon 19/12/22</b>	<b>50.2 wks</b>																		
103	RAS System Pre-Commissioning Meeting	Mon 10/01/22	Mon 10/01/22	0 days																		
104	<b>Pipe, Valve and Meter Replacement - RAS Train No.3</b>	<b>Mon 03/01/22</b>	<b>Fri 04/02/22</b>	<b>5 wks</b>																		
108	RAS Train No.3 and HPO Tank Start-Up and Commissioning of New Valves and Flowmeters	Thu 13/01/22	Fri 14/01/22	2 days																		
109	Commission RAS Train No.3 valves, and flowmeter	Fri 14/01/22	Fri 14/01/22	0 days																		
111	Performance Verification	Mon 17/01/22	Fri 04/02/22	15 days																		
112	<b>Pipe, Valve and Meter Replacement - RAS Train No.2</b>	<b>Mon 03/01/22</b>	<b>Fri 04/03/22</b>	<b>9 wks</b>																		
116	RAS Train No.2 and HPO Tank Start-Up and Commissioning of New Valves and Flowmeters	Thu 10/02/22	Fri 11/02/22	2 days																		
117	Commission RAS Train No.2 valves, and flowmeter	Fri 11/02/22	Fri 11/02/22	0 days																		
119	Performance Verification	Mon 14/02/22	Fri 04/03/22	15 days																		
120	<b>Pipe, Valve and Meter Replacement - RAS Train No.1</b>	<b>Tue 15/11/22</b>	<b>Mon 19/12/22</b>	<b>5 wks</b>																		
124	RAS Train No.1 and HPO Tank Start-Up and Commissioning of New Valves and Flowmeters	Fri 25/11/22	Mon 28/11/22	2 days																		
125	Commission RAS Train No.1 valves, and flowmeter	Mon 28/11/22	Mon 28/11/22	0 days																		
127	Performance Verification	Tue 29/11/22	Mon 19/12/22	15 days																		
128	<b>SYSTEM WIDE CFRP WRAP AND RELATED WORKS INCL. PIPE SUPPORTS, FLANGE TERMINATION SLEEVE</b>	<b>Mon 21/03/22</b>	<b>Fri 11/11/22</b>	<b>34 wks</b>																		
129	System Wide CFRP Wrap	Mon 21/03/22	Fri 11/11/22	34 wks																		
130	<b>INSTALL NEW WAS PIPE</b>	<b>Mon 21/03/22</b>	<b>Mon 13/02/23</b>	<b>47.2 wks</b>																		
131	WAS System Pre-Commissioning Meeting	Mon 14/11/22	Mon 14/11/22	0 days																		
135	Re-Fill and Start WAS Header No.1	Fri 25/11/22	Mon 28/11/22	2 days																		
136	Commission WAS Train No.3 pumps, valves, and flowmeter	Mon 28/11/22	Mon 28/11/22	0 days																		
137	Performance Verification	Tue 29/11/22	Mon 19/12/22	15 days																		
140	Re-Fill and Start WAS Header No.2	Fri 23/12/22	Mon 26/12/22	2 days																		
141	Commission WAS Train No.2 pumps, valves, and flowmeter	Mon 26/12/22	Mon 26/12/22	0 days																		
142	Performance Verification	Tue 27/12/22	Mon 16/01/23	15 days																		
145	Re-Fill and Start WAS Header No.3	Fri 20/01/23	Mon 23/01/23	2 days																		
146	Commission WAS Train No.1 pumps, valves, and flowmeter	Mon 23/01/23	Mon 23/01/23	0 days																		
147	Performance Verification	Tue 24/01/23	Mon 13/02/23	15 days																		
148	<b>PROJECT CLOSEOUT</b>	<b>Fri 25/11/22</b>	<b>Thu 16/03/23</b>	<b>15.8 wks</b>																		
149	<b>Demobilisation</b>	<b>Tue 14/02/23</b>	<b>Mon 27/02/23</b>	<b>2 wks</b>																		
150	Relocate Electrical, Teardown Interior Staging	Tue 14/02/23	Mon 20/02/23	1 wk																		
151	Teardown Exterior Laydown and Storage	Tue 21/02/23	Mon 27/02/23	5 days																		
152	Certificate of Substantial Performance	Fri 25/11/22	Fri 25/11/22	0 days																		
153	Certificate of Total Performance	Thu 16/03/23	Thu 16/03/23	0 days																		

# **APPENDIX B**

Electrical and Instrumentation Commissioning  
Checklists and Commissioning Forms



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**Form 103**

**CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE**

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We certify that the equipment listed below has been continuously operated for a minimum of three (3) consecutive days and that the equipment operates satisfactorily and meets it's specified operating criteria. No defects in the equipment were found and as such are classified as "conforming".

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

\_\_\_\_\_  
(Authorized representative of Supply Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized representative of Install Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized representative of Contract Administrator)

\_\_\_\_\_  
Date



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**Form 104**

**CERTIFICATE OF SATISFACTORY PROCESS PERFORMANCE**

---

We certify that the process system listed below has been continuously operated and tested as per the Specifications using process fluid and that the equipment meets its Performance Testing and Operating Criteria. No defects in the process system were found and as such are classified as “conforming”.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

---

(Authorized Representative of Supply Contractor)

---

Date

---

(Authorized Representative of Install Contractor)

---

Date

---

(Authorized Representative of Contract Administrator  
i.e. Commissioning Lead or Design Discipline Lead)

---

Date

---

(Authorized Representative of City)

---

Date





**ELECTRICAL PRE-COMMISSING CHECKLIST**



PROJECT	
Facility	Project Name:
Area:	Bid Opportunity:

Instrument Loop Verification Checks						
Instrument Tag	Control Panel Tag	Pass/Fail [P/F]	Tested By		Signature	Date (YYYY-MM-DD)
			Company	Name		
R810-FIT-1A						
R815-FIT-1B						
R820-FIT-2A						
R825-FIT-2B						
R830-FIT-3A						
R835-FIT-3B						
S941-FIT						
S942-FIT						
S943-FIT						

Instrument Calibration						
Instrument Tag	Flow Level [m <sup>3</sup> /min]		Tested By		Signature	Date (YYYY-MM-DD)
	4 mA	20 mA	Company	Name		
R810-FIT-1A						
R815-FIT-1B						
R820-FIT-2A						
R825-FIT-2B						
R830-FIT-3A						
R835-FIT-3B						
S941-FIT						
S942-FIT						
S943-FIT						

# **APPENDIX C**

Instrument List

## INSTRUMENTATION CONDITION ASSESSMENT LIST

PROJECT NO.: 21-0107-001  
 PROJECT TITLE: NEWPCC Return Activated Sludge Piping System Refurbishment  
 DATE: 2021-07-19

No.	Return Activated Sludge	Instrument Tag	Instrument Type	Manufacture	Existing Model Number	Manufacture	New Model Number	Control Panel	Power Source	Description	Status (Replace, Repair, Remain)	Location
1	3B Pipe	R835-FE-3B	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 3B, Secondary Control Room	Panel H, Reactor Electrical Room	West side of the Return Activated Sludge 3	Replace	Inline with Return Activated Sludge 3B Pipe
2		R835-FIT-3B	Flow Transmitter	FOXBORO	E965-1B-C	Siemens	MAG 6000-7ME6920-2PA10-1AA0	Instrument Rack 3B, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	Panel beside the Primary Effluent
3		R835-FV-3B	Return Activated Sludge	BAILEY	AV2321000		Not Required	Instrument Rack 3B, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow Valve Positioner	Remain	Panel beside the Primary Effluent
4		R835-ZT-3B	Valve Position Transmitter	ACROMAG	150T-SM 3.5		Not Required	Secondary Control Room	Panel H, Reactor Electrical Room	Valve Position Transmitter	Remain	Mounted on R835-FV-3B
5		R835-FG-3B	Ultrasonic Generator	FOXBORO	A2040US		Not Required	Instrument Rack 3B, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Replace	Panel beside the Primary Effluent
6	3A Pipe	Missing Tag (R830-FE-3A)	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 3A, Secondary Control Room	Panel H, Reactor Electrical Room	East side of the Return Activated Sludge 3	Replace	Inline with Return Activated Sludge 3A Pipe
7		R830-FIT-3A	Flow Transmitter	FOXBORO	E965-1B-C	Siemens	MAG 6000-7ME6920-2PA10-1AA0	Instrument Rack 3A, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	West side of the Primary effluent 3A pipe
8		R830-FV-3A	Return Activated Sludge	ABB	AV2321000		Not Required	Instrument Rack 3A, Secondary Control Room	Panel H, Reactor Electrical Room	Valve Pressure Indicator	Remain	West side of the Primary effluent 3A pipe
9		R830-ZT-3A	Valve Position Transmitter	ACROMAG	150T-SM 3.5		Not Required	Secondary Control Room	Panel H, Reactor Electrical Room	Valve Position Transmitter	Remain	Mounted on R830-FV-3A
10		R830-FG-3A	Ultrasonic Generator	FOXBORO	A2040US		Not Required	Instrument Rack 3A, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Replace	West side of the Primary effluent 3A pipe
11	2B Pipe	R825-FE-2B	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 2B, Secondary Control Room	Panel H, Reactor Electrical Room	West side of the Return Activated Sludge 2	Replace	Inline with Return Activated Sludge 2B Pipe
12		R825-FIT-2B	Flow Transmitter	FOXBORO	E965-1B-C	Siemens	MAG 6000-7ME6920-2PA10-1AA0	Instrument Rack 2B, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	West side of the Primary effluent 2B pipe
13		R825-FV-2B	Return Activated Sludge	ABB	AV2321000		Not Required	Instrument Rack 2B, Secondary Control Room	Panel H, Reactor Electrical Room	Valve Pressure Indicator	Remain	West side of the Primary effluent 2B pipe
14		R825-ZT-2B	Valve Position Transmitter	ACROMAG	150T-SM 3.5		Not Required	Secondary Control Room	Panel H, Reactor Electrical Room	Valve Position Transmitter	Remain	Mounted on R825-FV-2B
15		R825-FG-2B	Ultrasonic Generator	FOXBORO	A2040US		Not Required	Instrument Rack 2B, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Replace	West side of the Primary effluent 2B pipe
16	2A Pipe	R820-FE-2A	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 2A, Secondary Control Room	Panel H, Reactor Electrical Room	East side of the Return Activated Sludge 2A Pipe	Replace	Inline with Return Activated Sludge 2A Pipe
17		R820-FIT-2A	Flow Transmitter	FOXBORO	E965-1B-C	Siemens	MAG 6000-7ME6920-2PA10-1AA0	Instrument Rack 2A, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	West side of the Primary effluent 2A pipe
18		R820-FV-2A	Return Activated Sludge	BAILEY	AV2321000		Not Required	Instrument Rack 2A, Secondary Control Room	Panel H, Reactor Electrical Room	Valve Pressure Indicator	Remain	West side of the Primary effluent 2A pipe
19		R820-ZT-2A	Valve Position Transmitter	ACROMAG	150T-SM 3.5		Not Required	Secondary Control Room	Panel H, Reactor Electrical Room	Valve Position Transmitter	Remain	Mounted on R820-FV-2A
20		R820-FG-2A	Ultrasonic Generator	FOXBORO	A2040US		Not Required	Instrument Rack 2A, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Replace	West side of the Primary effluent 2A pipe
21	1B Pipe	R815-FV-1B	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 1B, Secondary Control Room	Panel H, Reactor Electrical Room	West side of the Return Activated Sludge 1	Replace	Inline with Return Activated Sludge 1B Pipe
22		R815-FIT-1B	Flow Transmitter	FOXBORO	IM196-SECT810-AB	Siemens	MAG 6000-7ME6920-2PA10-1AA0	Instrument Rack 1B, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	West side of the Primary effluent 1B pipe
23		R815-FV-1B	Return Activated Sludge	BAILEY	AV2321000		Not Required	Instrument Rack 1B, Secondary Control Room	Panel H, Reactor Electrical Room	Valve Pressure Indicator	Remain	West side of the Primary effluent 1B pipe
24		R815-ZT-1B	Valve Position Transmitter	ACROMAG	150T-SM 3.5		Not Required	Secondary Control Room	Panel H, Reactor Electrical Room	Valve Position Transmitter	Remain	Mounted on R815-FV-1B
25		R815-FG-1B	Ultrasonic Generator	FOXBORO	A2040US		Not Required	Instrument Rack 1B, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Replace	West side of the Primary effluent 1B pipe
26	1A Pipe	R810-FE-1A	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 1A, Secondary Control Room	Panel H, Reactor Electrical Room	East side of the Return Activated Sludge 1A Pipe	Replace	Inline with Return Activated Sludge 1A Pipe
27		Missing Tag(R810-FIT-1A)	Flow Transmitter	FOXBORO	E965-1B-C	Siemens	MAG 6000-7ME6920-2PA10-1AA0	Instrument Rack 1A, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	West side of the Primary effluent 1A pipe
28		R810-FV-1A	Return Activated Sludge	ABB	AV2321000		Not Required	Instrument Rack 1A, Secondary Control Room	Panel H, Reactor Electrical Room	Valve Pressure Indicator	Remain	West side of the Primary effluent 1A pipe
29		R810-ZT-1A	Valve Position Transmitter	ACROMAG	150T-SM 3.5		Not Required	Secondary Control Room	Panel H, Reactor Electrical Room	Valve Position Transmitter	Remain	Mounted on R805-FV-1A
30		R810-FG-1A	Ultrasonic Generator	FOXBORO	A2040US		Not Required	Instrument Rack 1A, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Replace	West side of the Primary effluent 1A pipe
31	WAS TRN 3	S941-FE	Flow Meter	FISCHER & PORTER	10D1435A/U	Siemens	MAG3100-7ME63104H112AA2	Secondary Control Room	Panel FDP-B4, Secondary Clarifiers Electrical Room	Flowmeter For WAS HEADER 1	Replace	Inline with WAS HEADER 1 (WAS TRN 3)
32		S941-FG	Magmeter Ultrasonic Gen	FISCHER & PORTER	55UC2210A		Not Required	Secondary Control Room	Panel FDP-B4, Secondary Clarifiers Electrical Room	Magmeter Ultrasonic Generator For WAS HEADER 1	Replace	Beside WAS HEADER 1 (WAS TRN 3)
33		S941-FIT	Flow Transmitter	FISCHER & PORTER	50PZ10006	Siemens	MAG 6000-7ME6920-2PA10-1AA0	Secondary Control Room	Panel FDP-B4, Secondary Clarifiers Electrical Room	Flow Transmitter For WAS HEADER 1	Replace	Beside WAS HEADER 1 (WAS TRN 3)
34	WAS TRN 2	S942-FE	Flow Meter	FISCHER & PORTER	10D1435A/U	Siemens	MAG3100-7ME63104H112AA2	Secondary Control Room	Panel FDP-B4, Secondary Clarifiers Electrical Room	Flowmeter For WAS HEADER 2	Replace	Inline with WAS HEADER 2 (WAS TRN 2)
35		S942-FG	Magmeter Ultrasonic Gen	FISCHER & PORTER	55UC2210A		Not Required	Secondary Control Room	Panel FDP-B4, Secondary Clarifiers Electrical Room	Magmeter Ultrasonic Generator For WAS HEADER 2	Replace	Beside WAS HEADER 2 (WAS TRN 2)
36		S942-FIT	Flow Transmitter	FISCHER & PORTER	50PZ10006	Siemens	MAG 6000-7ME6920-2PA10-1AA0	Secondary Control Room	Panel FDP-B4, Secondary Clarifiers Electrical Room	Flow Transmitter For WAS HEADER 2	Replace	Beside WAS HEADER 2 (WAS TRN 2)
37	WAS TRN 1	S943-FE	Flow Meter	FISCHER & PORTER	10D1435A/U	Siemens	MAG3100-7ME63104H112AA2	Secondary Control Room	Panel FDP-B4, Secondary Clarifiers Electrical Room	Flowmeter For WAS HEADER 3	Replace	Inline with WAS HEADER 3 (WAS TRN 1)
38		S943-FG	Magmeter Ultrasonic Gen	FISCHER & PORTER	55UC2210A		Not Required	Secondary Control Room	Panel FDP-B4, Secondary Clarifiers Electrical Room	Magmeter Ultrasonic Generator For WAS HEADER 3	Replace	Beside WAS HEADER 3 (WAS TRN 1)
39		S943-FIT	Flow Transmitter	FISCHER & PORTER	50PZ10006	Siemens	MAG 6000-7ME6920-2PA10-1AA0	Secondary Control Room	Panel FDP-B4, Secondary Clarifiers Electrical Room	Flow Transmitter For WAS HEADER 3	Replace	Beside WAS HEADER 3 (WAS TRN 1)

**KGS**  
GROUP

---

Experience in Action

**APPENDIX F - LEAD PAINT TEST REPORTS**



February 1, 2019

File No. 16-0107-023

The City of Winnipeg  
Wastewater Planning & Project Delivery Branch  
110-1199 Pacific Avenue  
Winnipeg, Manitoba  
R3E 3S8

ATTENTION: Mr. Brian Station  
Project Manager

RE: NEWPCC RAS Paint Assessment and Sampling Program  
Lead Paint Sampling Results

---

3rd Floor  
865 Waverley Street  
Winnipeg,  
Manitoba  
R3T 5P4  
204.896.1209  
fax: 204.896.0754  
www.ksgroup.com

Dear Mr. Station:

As part of the Return Activated Sludge Pipe Condition Assessment and Preliminary Design project at the NEWPCC, an Engineering Scope Change was approved to include lead paint sampling of four existing pipe systems in order to confirm the absence and/or presence of total lead and leachable lead concentrations in paints at the site.

KGS Group designated personnel conducted the paint sampling at NEWPCC on December 13, 2018. Three samples were collected on-site from various locations along the existing piping of each of the beige (RAS 1), orange (RAS 2), and yellow (RAS 3) painted pipe systems. The fourth sample (black painted pipe system from RAS 2 HPO Reactor Inlet) was collected on December 17, 2018 from a recently removed sample pipe from the Pilot Inspection Program, located off site at Testlabs International. Specific locations of paint sample collection are listed in Table 1, and photos of the locations are shown in Photos 1 to 5. All paint samples were placed in dedicated labelled and sealed plastic bags and subsequently submitted to Maxxam Analytics Ltd. in Winnipeg, Manitoba on December 17, 2018 for analysis of total lead and leachable lead concentrations.

### **Results**

As per the Surface Coatings Materials Regulations (SOR/2016-193) of the Canada Consumer Product Safety Act, total lead concentrations are restricted to 90 mg/kg in consumer paint. Leachable lead concentrations were assessed using Toxicity Characteristic Leaching Procedure (TCLP) testing, and compared to the limits identified in The Manitoba Dangerous Goods Handling and Transportation Act Regulation – Hazardous Waste Regulation (MR 195/2015). Materials exceeding a concentration of 5 mg/L in waste extract are considered “leachable toxic waste” materials (MR 195/2015).

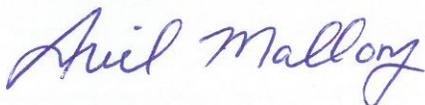
All four paint samples submitted had concentrations above the allowable level of total lead in paint (90 mg/kg) as per the federal Surface Coatings Materials Regulation. One sample (S-01; beige painted pipe system) exceeded allowable concentrations of leachable lead (5 mg/L) as per the Manitoba Dangerous Goods

Handling and Transportation Act Regulation. Leachable lead concentrations in the remaining three samples (S-02, S-03, and S-04) ranged from non-detectable (<0.50 mg/L) to 2.7 mg/L, well below The Manitoba Dangerous Goods Handling and Transportation Act Regulation limits of 5 mg/L of leachable lead. A summary of the laboratory results with comparison to applicable criteria is included in Table 1 (attached).

### **Conclusions**

Based on the laboratory results, paint present on all four pipe systems is considered to be lead-based (>90 mg/kg). Materials coated with non-leachable lead-based paint (total lead >90 mg/kg and leachable lead <5 mg/L) can be disposed of at any landfill as regular construction waste. All leachable lead painted pipes (beige painted piping) must be disposed of at a licensed hazardous waste facility in accordance with Manitoba's Dangerous Goods Handling and Transportation Act – Hazardous Waste Regulation. Proper precautions must be taken during removal activities to protect worker health and safety.

Prepared By:



Ariel Mallory, B.Sc.  
Environmental Scientist-Technologist

Approved By:



Bonnie Hoffensetz, M.Sc.  
Sr. Environmental Scientist/  
Asst. Dept. Head

Cc: Jason Smith, P. Eng., KGS Group



Photo 1. Paint Sample S-01 location (beige piping system; RAS 1; composite sample).



Photo 2. Paint Sample S-01 location (beige piping system; RAS 1; composite sample).



Photo 3. Paint Sample S-02 location (orange piping system; RAS 2).



Photo 4. Paint Sample S-03 location (yellow piping system; RAS 3).



Photo 5. Paint Sample S-04 location (black piping system; RAS 2 HPO Reactor Inlet) from off-site pipe located at Testlabs International.

**TABLE 1  
LEAD PAINT SAMPLING  
NEWPCC RAS PAINT ASSESSMENT AND SAMPLING PROGRAM**

Sample ID <sup>(1)</sup>	Location	Colour	Comments	Total Lead (mg/kg)	Leachable Lead (mg/L)
<b>RDL</b>				<b>10</b>	<b>0.50</b>
S-01	RAS Train 1: RAS pump 9 suction piping	Beige	Fair condition; paint flaking in some areas.	<b>6600</b>	<b>6.4</b>
S-02	RAS Train 2: Clarifier 11 outlet piping	Orange	Fair condition; paint flaking in some areas.	<b>20,000</b> <sup>(2)</sup>	2.7
S-03	RAS Train 3: Clarifier 26 outlet piping	Yellow	Good condition.	<b>1300</b>	<0.50
S-04	RAS Train 2: HPO Reactor inlet piping (off-site pipe sample at Testlabs)	Black	Good condition; very thin layer.	<b>210</b>	<0.50
<b>Federal Surface Coating Materials Regulations (SOR/2005-109)</b>				90 <sup>(3)</sup>	-
<b>The Dangerous Goods Handling and Transportation Act Regulation (MR 195/2015, including Amendment 29/2018)</b>				-	5 <sup>(4)</sup>

**Notes:**

RDL = Reportable detection limit.

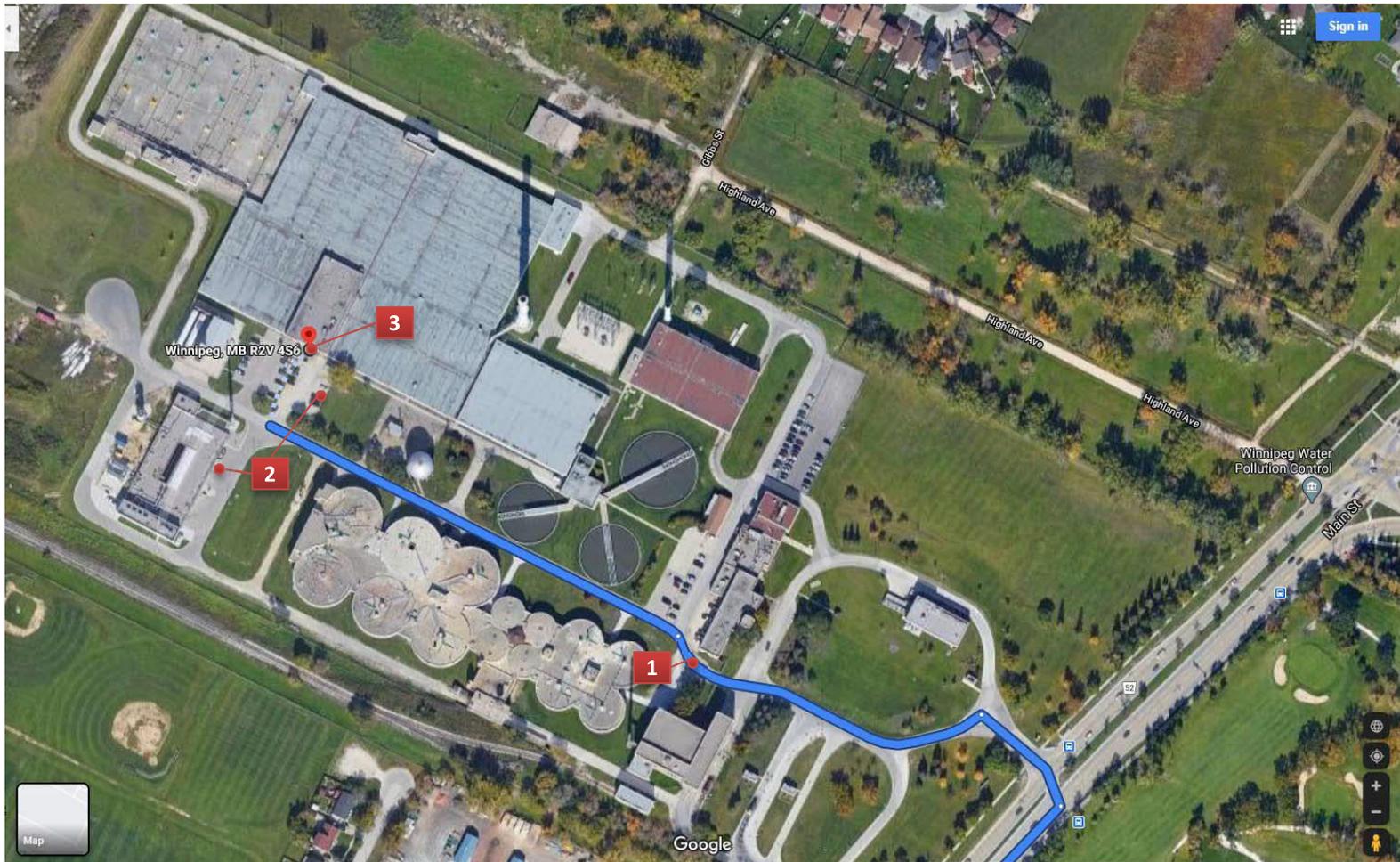
1. Samples obtained on December 13, 2018 (S-01, S-02, and S-03) and December 17, 2018 (S-04) by KGS Group.
2. Detection limit raised to 50 mg/kg due to dilution to bring analyte within the calibrated range.
3. Minimum concentration of lead in paint to be considered lead-based is 90 mg per kg under the Surface Coating Materials Regulations (SOR/2005-109)
4. Minimum leachable metal concentrations considered hazardous as specified in Manitoba's Dangerous Goods Handling and Transportation Act Regulation.

**BOLD** - Exceeds Applicable Criteria

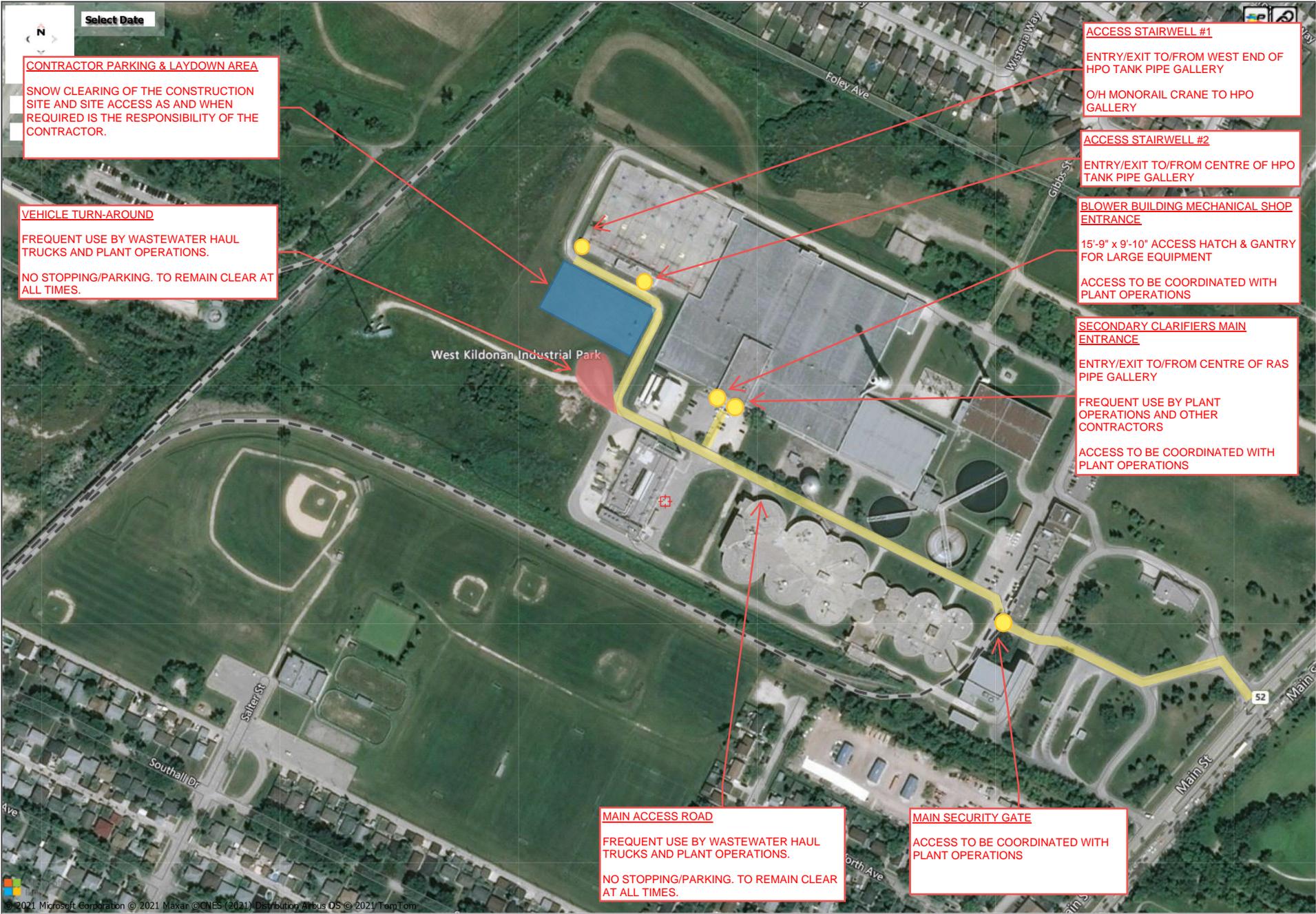
**APPENDIX G - SITE PLANS FOR LAYDOWN AREA AND ACCESS ROUTES**

## BIDDERS SITE TOUR: Meet outside Blower Building Entrance

North End Sewage Treatment Plant (NEWPCC),  
2230 Main Street, Winnipeg, MB



- 1 CALL TELEPHONE NUMBER AT ACCESS GATE
- 2 PROCEED TO VISITOR PARKING AREAS
- 3 MEET OUTSIDE DOOR TO BLOWER BUILDING / MECHANICAL MAINTENANCE SHOP



Select Date

**CONTRACTOR PARKING & LAYDOWN AREA**

SNOW CLEARING OF THE CONSTRUCTION SITE AND SITE ACCESS AS AND WHEN REQUIRED IS THE RESPONSIBILITY OF THE CONTRACTOR.

**VEHICLE TURN-AROUND**

FREQUENT USE BY WASTEWATER HAUL TRUCKS AND PLANT OPERATIONS.  
NO STOPPING/PARKING. TO REMAIN CLEAR AT ALL TIMES.

**ACCESS STAIRWELL #1**

ENTRY/EXIT TO/FROM WEST END OF HPO TANK PIPE GALLERY  
O/H MONORAIL CRANE TO HPO GALLERY

**ACCESS STAIRWELL #2**

ENTRY/EXIT TO/FROM CENTRE OF HPO TANK PIPE GALLERY

**BLOWER BUILDING MECHANICAL SHOP ENTRANCE**

15'-9" x 9'-10" ACCESS HATCH & GANTRY FOR LARGE EQUIPMENT  
ACCESS TO BE COORDINATED WITH PLANT OPERATIONS

**SECONDARY CLARIFIERS MAIN ENTRANCE**

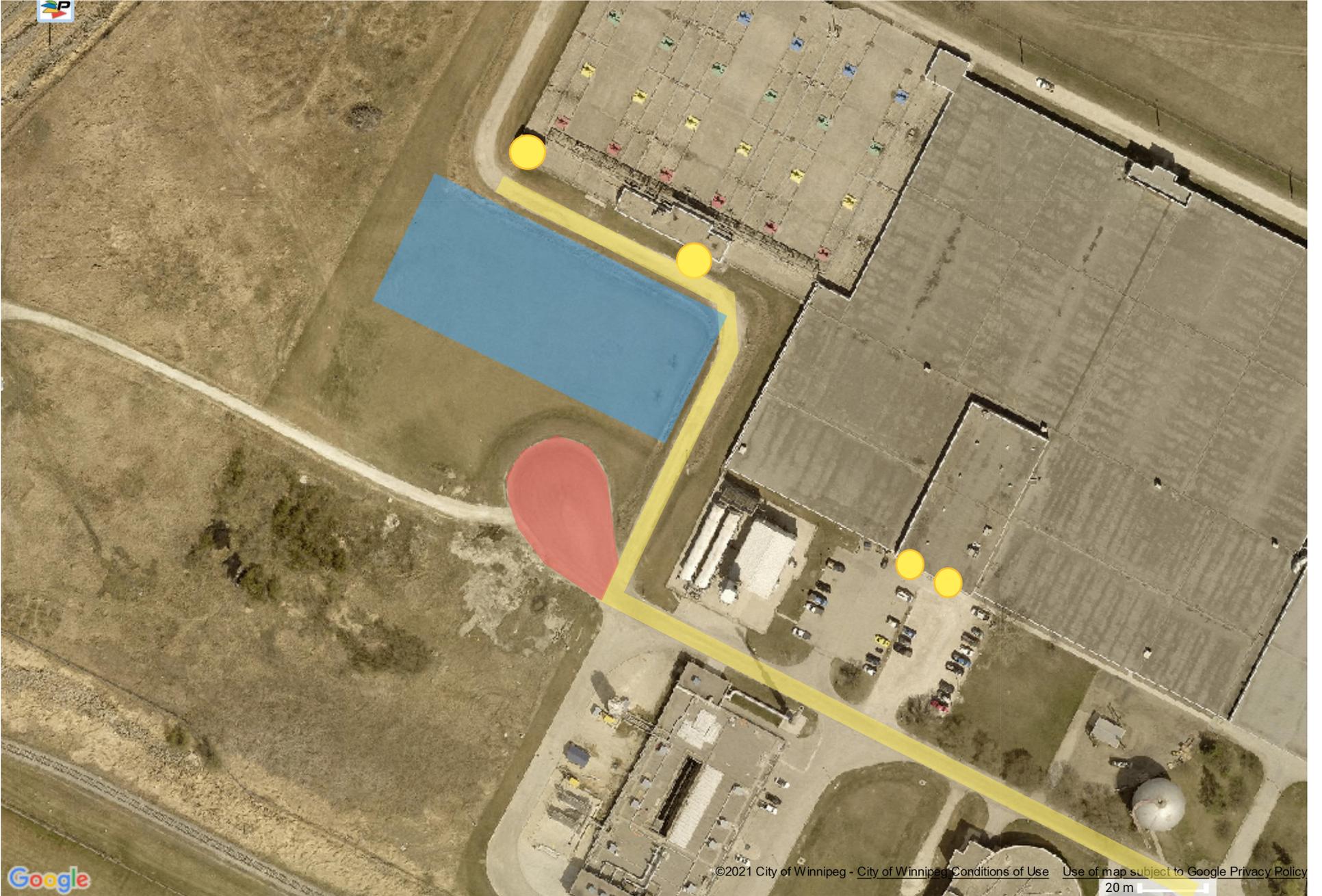
ENTRY/EXIT TO/FROM CENTRE OF RAS PIPE GALLERY  
FREQUENT USE BY PLANT OPERATIONS AND OTHER CONTRACTORS  
ACCESS TO BE COORDINATED WITH PLANT OPERATIONS

**MAIN ACCESS ROAD**

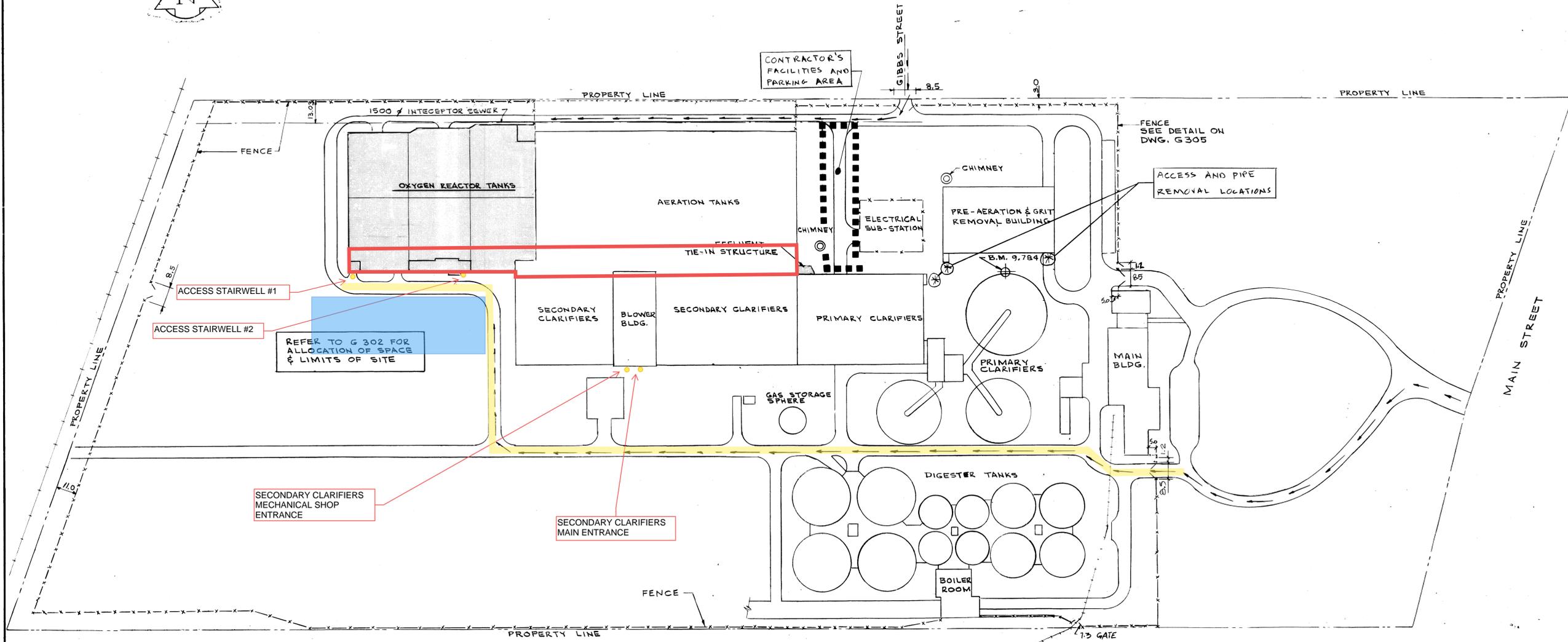
FREQUENT USE BY WASTEWATER HAUL TRUCKS AND PLANT OPERATIONS.  
NO STOPPING/PARKING. TO REMAIN CLEAR AT ALL TIMES.

**MAIN SECURITY GATE**

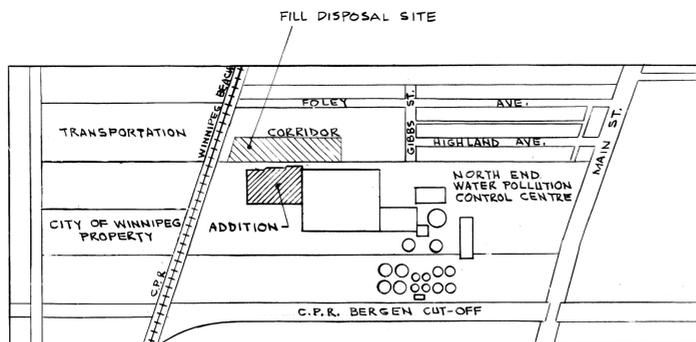
ACCESS TO BE COORDINATED WITH PLANT OPERATIONS







NEP-1043



DISPOSAL SITE LOCATION PLAN  
1:700

SHOP DRAWING REFERENCE		
DESCRIPTION	SUPPLIER	NUMBER
Site Signs	W.W. Construction	2322

**METRIC**  
WHOLE NUMBERS INDICATE MILLIMETRES  
DECIMALIZED NUMBERS INDICATE METRES

NO	REVISIONS	DATE	APP
4	REVISED TO AS-BUILT	85-07-12	[Signature]
3	GENERAL REVISIONS	85-11-25	[Signature]
2	REVISED FENCE LOCATION	83-08-29	[Signature]
1	ISSUED FOR TENDER	82-12-06	[Signature]
0	ISSUED FOR CITY REVIEW	82-10-15	[Signature]



W.L. WARDROP & ASSOCIATES LTD.  
MacLAREN ENGINEERS INC.

DESIGNED BY: T.R.P. DRAWN BY: H.J.C.  
CHECKED BY: [Signature] DATE: 82-11-26  
APPROVED BY: [Signature] DATE: Dec/82

FOR INFORMATION ONLY

REVISED AS CONSTRUCTED  
DATE JULY 1985 BY CSA  
CHECKED BY [Signature]

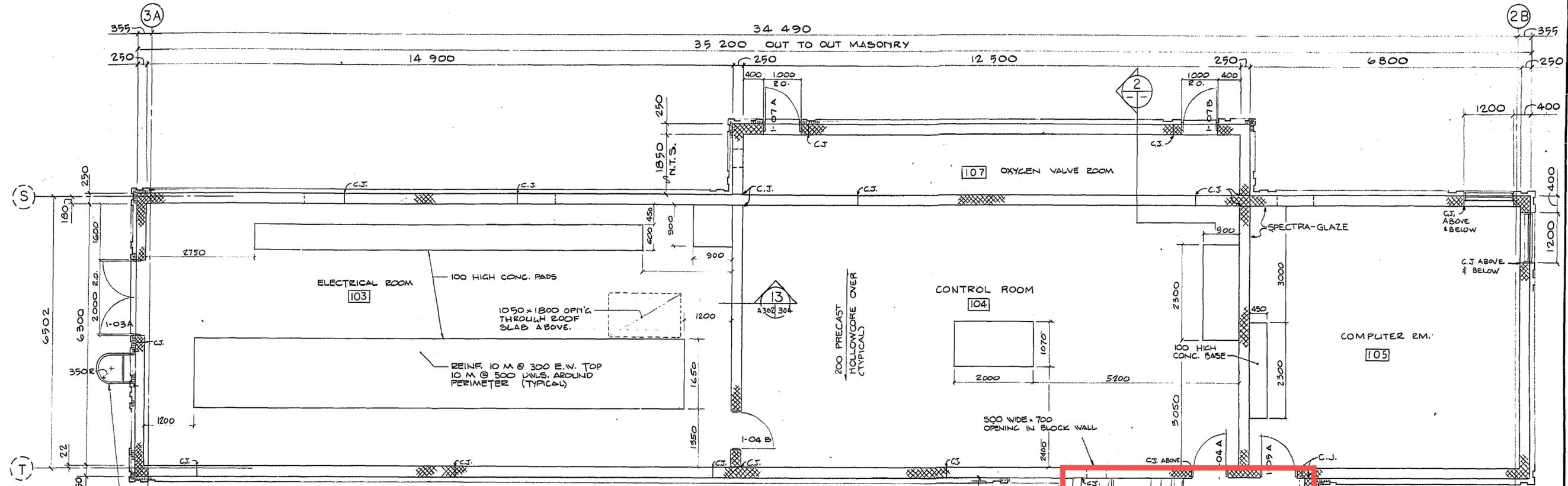


NORTH END WATER POLLUTION CONTROL CENTRE  
SECONDARY TREATMENT EXPANSION  
OXYGEN REACTOR TANKS  
OVERALL SITE PLAN

RELEASED FOR CONSTRUCTION DATE: [Signature] 1982-11-29  
SCALE: 1:1200 DRAWING NO.: NEP 1043

NR11219

REF. OF DRAWING NO. **NEP 1074**  
**DETAILS REACTOR BLDG. PLAN, SECTION & ELEV.**

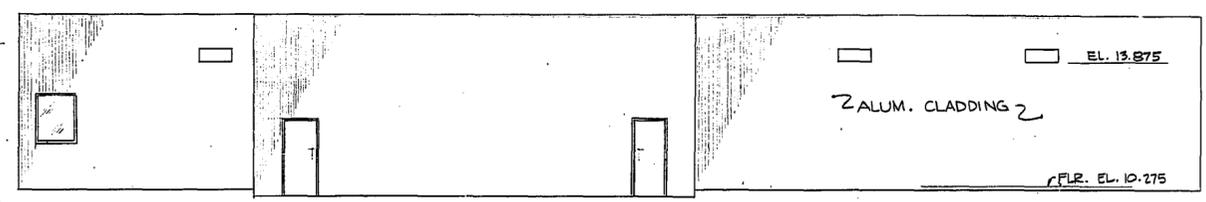
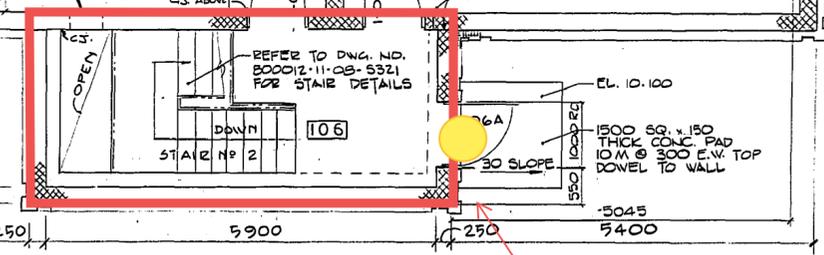


STEEL ACCESS LADDER TO ROOF C/W SAFETY CAGE. PROVIDE:  
 • 19# RUNGS @ 300 O.C.  
 • 9 x 50 RAILS  
 • 6 x 50 HOOPS  
 • 5 x 45 SLATS

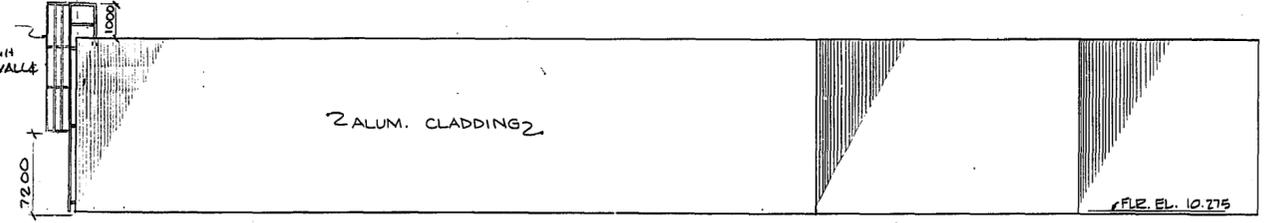
**NOTE**  
 FOR PILASTER LOCATIONS IN REACTOR BLDG. WALLS SEE SHOP DWG. #2395

DESCRIPTION	SUPPLIER	NUMBER
Hollowcore Roof-Reactor Building	Genstar Structures	2394
Masonry Pilasters	Boge & Boge	2395
Ladder Details	Shopost Iron Works	2416
Aluminum Siding Details	Advance Roofing	2422
Roof Insulation Details	Aerofoam	2425

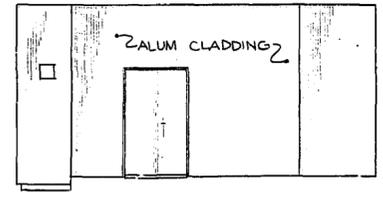
**1** PLAN - REACTOR BUILDING  
 FIN. FLR. ELEV. 10.275 UNLESS NOTED  
 1:50



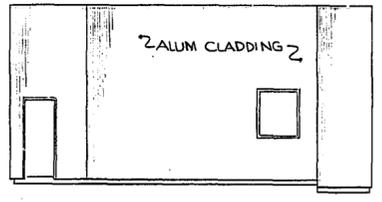
**NORTH ELEVATION**  
 1:100



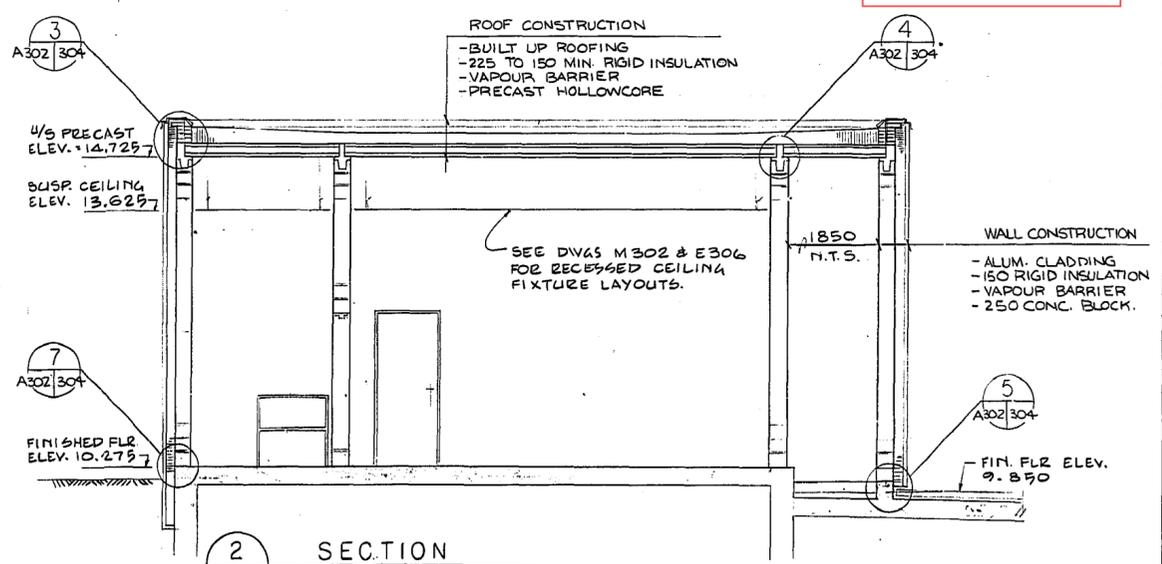
**SOUTH ELEVATION**  
 1:100



**WEST ELEVATION**  
 1:100



**EAST ELEVATION**  
 1:100

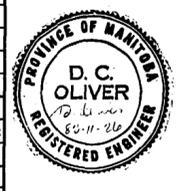


**2** SECTION  
 1:50

REVISED AS CONSTRUCTED  
 DATE JULY 25 BY SA  
 CHECKED BY CA

**METRIC**  
 WHOLE NUMBERS INDICATE MILLIMETRES  
 DECIMALIZED NUMBERS INDICATE METRES

NO	REVISIONS	DATE	APP.
2	REVISED TO AS-BUILT	85-07-12	CA
1	ISSUED FOR TENDER	82-12-06	CA
0	ISSUED FOR CLIENT REVIEW	82-10-15	CA

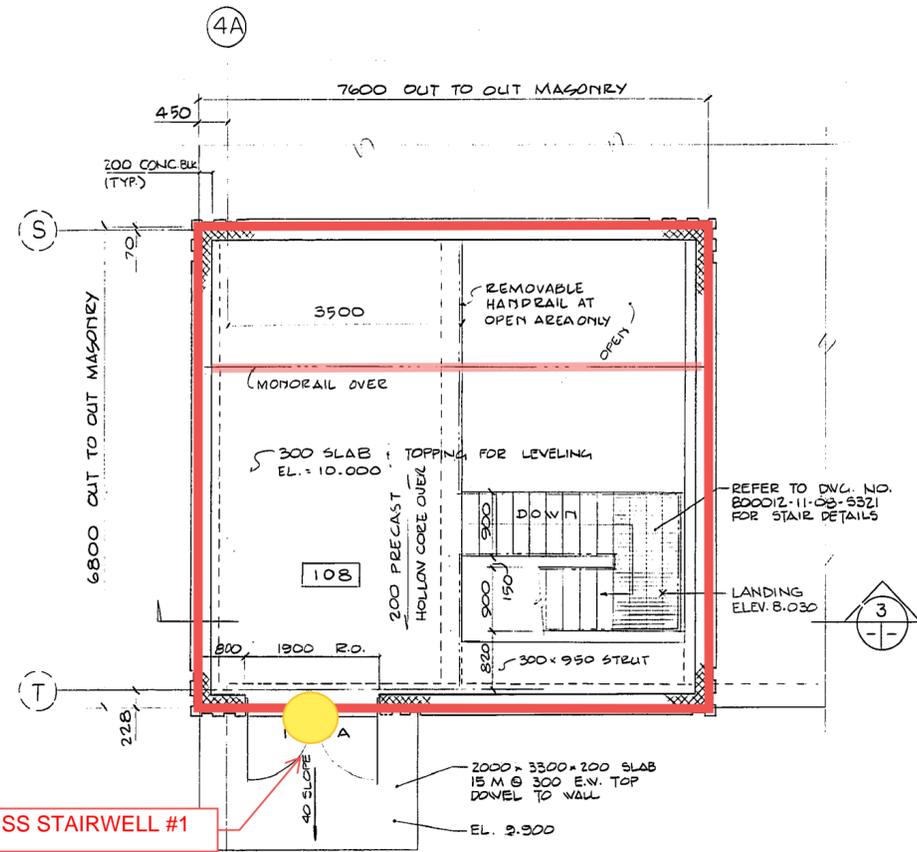


W.L. WARDROP & ASSOCIATES LTD.  
 MacLAREN ENGINEERS INC.  
 DESIGNED BY: C.D.S.  
 CHECKED BY: 120.  
 DRAWN BY: ts  
 DATE: 82.10.08  
 APPROVED BY: [Signature]  
 DATE: Dec 82

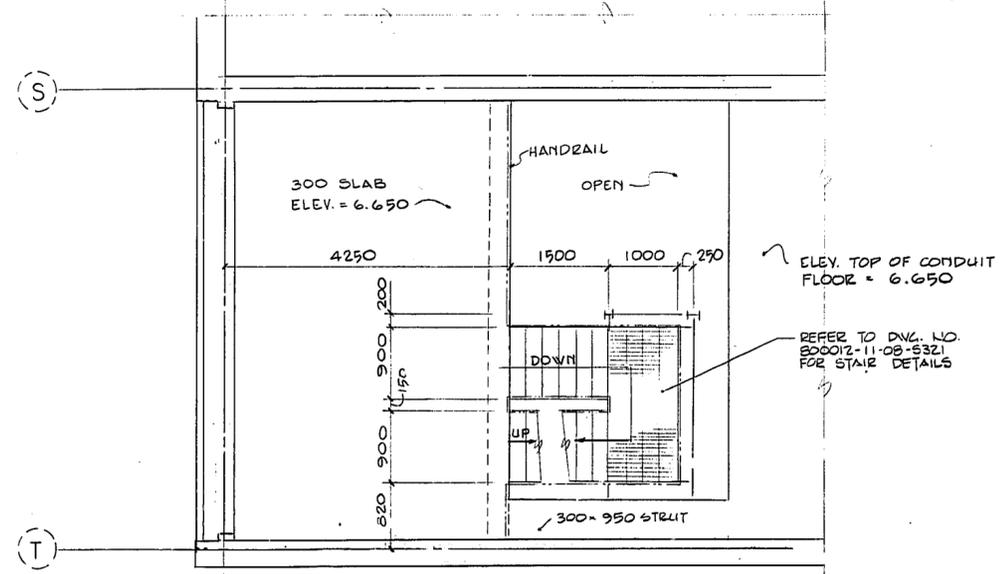
**THE CITY OF WINNIPEG**  
 WORKS & OPERATIONS DIVISION  
 WATERWORKS, WASTE & DISPOSAL DEPARTMENT

**NORTH END WATER POLLUTION CONTROL CENTRE SECONDARY TREATMENT EXPANSION OXYGEN REACTOR TANKS ARCHITECTURAL REACTOR BUILDING PLAN, SECTION & ELEVATIONS**  
 RELEASED FOR CONSTRUCTION DATE: 1982.11.29  
 SCALE: AS SHOWN  
 DRAWING NO.: NEP 1074

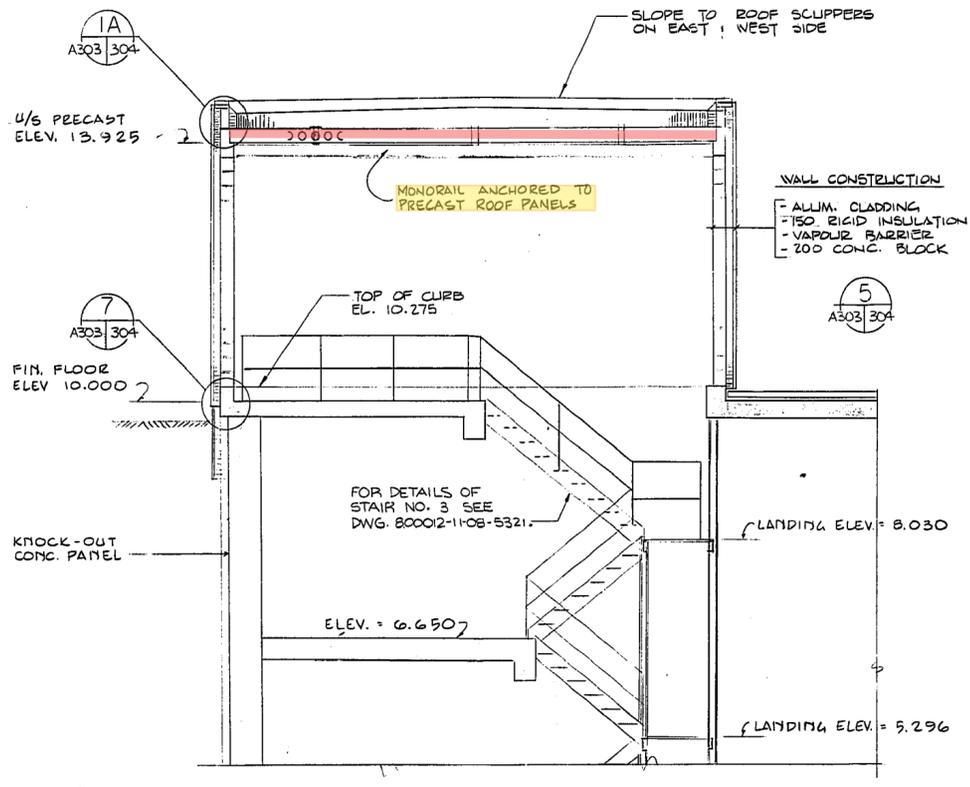
REF. or DRAWING NO. NEP 1075  
**DETAILS - Equ. Access Bldg.**



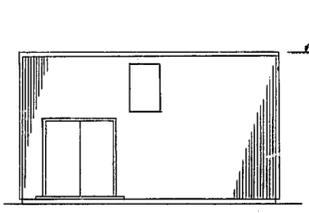
1 PLAN AT ELEVATION 10.275



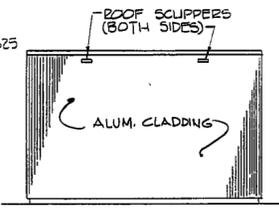
2 PLAN AT INTERMEDIATE LANDINGS



3 SECTION



SOUTH ELEVATION  
 NORTH ELEVATION (NO DOORS OR EXHAUST GRILLE)  
 1:100

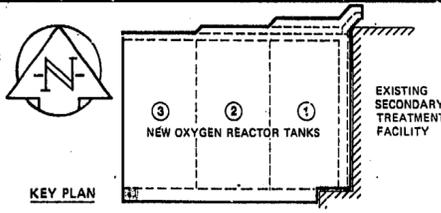


WEST ELEVATION  
 EAST ELEVATION SIMILAR  
 1:100

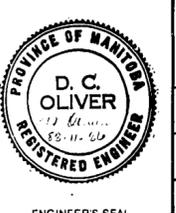
SHOP DRAWING REFERENCE		
DESCRIPTION	SUPPLIER	NUMBER
Aluminum Siding Details	Advance Roofing	2423
Monorail Support System	Richards-Wilcox	2429
Monorail Trolley	Richards-Wilcox	2430
Chain Hoist	Richards-Wilcox	2431

REVISED AS CONSTRUCTED  
 DATE JULY 1985 BY CSA  
 CHECKED BY [Signature]

**METRIC**  
 WHOLE NUMBERS INDICATE MILLIMETRES  
 DECIMALIZED NUMBERS INDICATE METRES



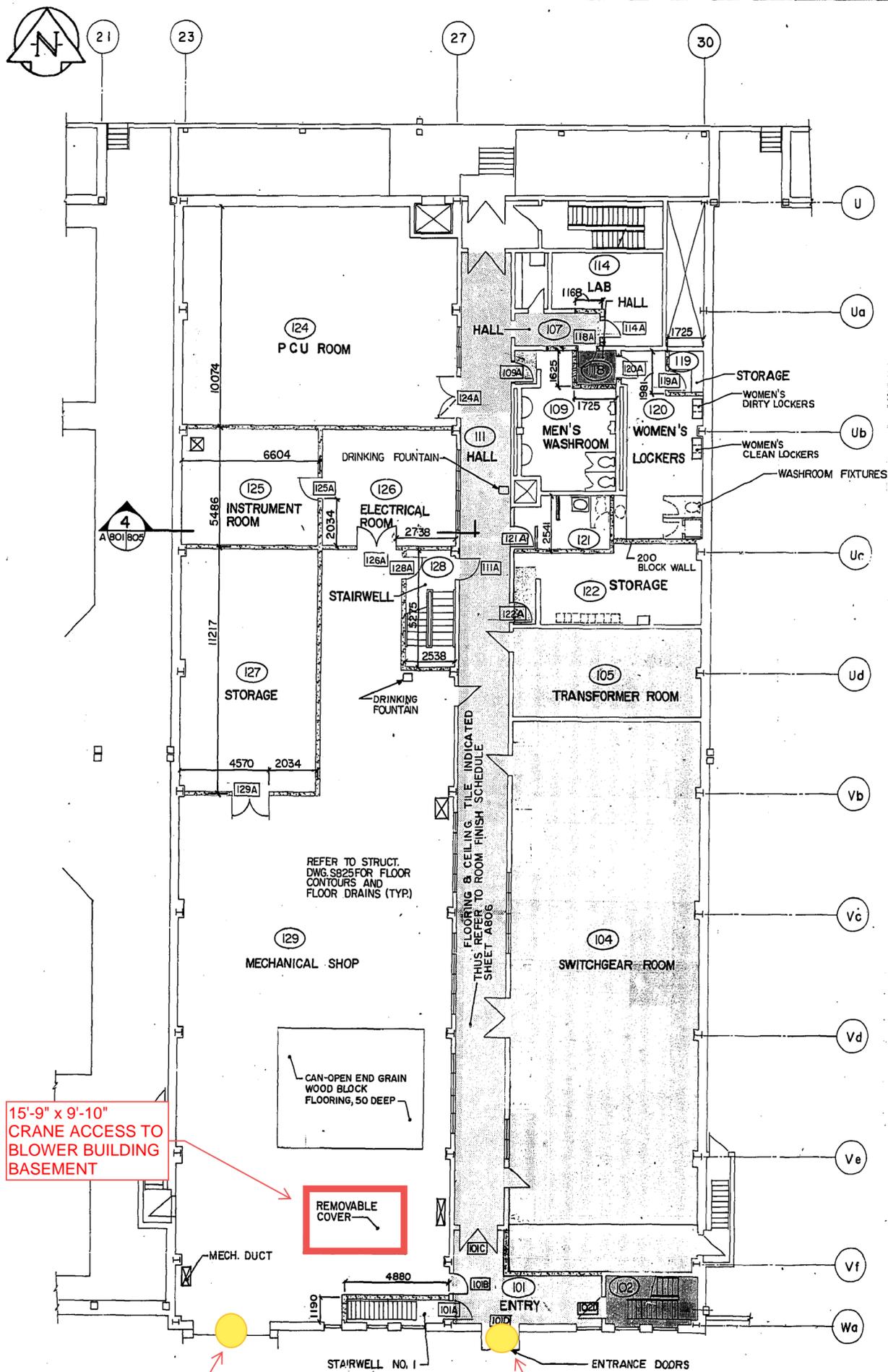
NO.	REVISIONS	DATE	APP.
2	REVISED TO AS-BUILT	85-07-12	CSA
1	ISSUED FOR TENDER	82-12-06	
0	ISSUED FOR CLIENT REVIEW	82-12-12	



W.L. WARDROP & ASSOCIATES LTD.  
 MacLAREN ENGINEERS INC.  
 DESIGNED BY: C.P.S.  
 CHECKED BY: [Signature]  
 DRAWN BY: D.D. [Signature]  
 DATE: 82-10-08  
 APPROVED BY: [Signature] DATE: Dec 1982

**THE CITY OF WINNIPEG**  
 WORKS & OPERATIONS  
 DIVISION  
 WATERWORKS, WASTE & DISPOSAL DEPARTMENT

NORTH END WATER POLLUTION CONTROL CENTRE  
 SECONDARY TREATMENT EXPANSION  
 ARCHITECTURAL  
 EQUIPMENT ACCESS BUILDING  
 PLAN, SECTION & ELEVATIONS  
 RELEASED FOR CONSTRUCTION DATE: 1982-11-29  
 SCALE: 1:50 4-707ED  
 DRAWING NO.: NEP 1075



15'-9" x 9'-10"  
CRANE ACCESS TO  
BLOWER BUILDING  
BASEMENT

REMOVABLE  
COVER

NEWPCC  
MECHANICAL SHOP  
ENTRANCE

PLAN ABOVE ELEV. 9.905  
1:120

SECONDARY  
CLARIFIER  
BUILDING MAIN  
ENTRANCE

AS - BUILT		
DATE	FB. NO.	PAGE
MAY 88		

Access to the maintenance shop located in the Secondary Clarifier Building shall only be provided during typical working hours for plant personnel (i.e. 08:00 to 16:00).

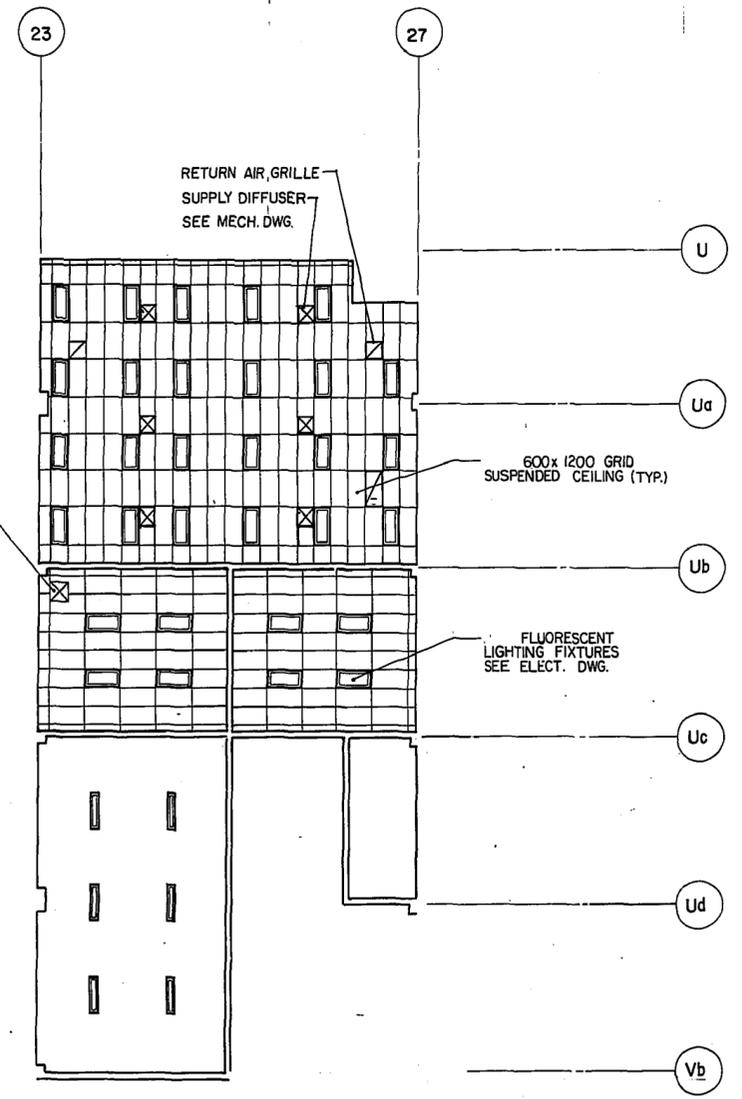
A minimum of 5 business days notice is required prior to use of the gantry crane and blower room access hatch located in the maintenance shop to reduce disruption of typical plant maintenance work.

Operation of the gantry crane shall be by the Contractor under direction and supervision of City staff. Responsibility for safe operation of the crane remains with the Contractor.

The Contractor shall develop a simple lift plan prior to use and retain this plan for presentation upon request by the Contract Administrator.

This plan shall include:

- The proposed load and rigging arrangement, and
- Results of a detailed inspection of the crane and rigging



REFLECTED CEILING PLAN  
NOTE: (AREAS NOT SHOWN) REFER TO SHEET E833 FOR LAYOUT

LEGEND

	CONC. BLOCK WALLS
	WALLS
	DOORS
	DOORS TO REMAIN

METRIC  
WHOLE NUMBERS INDICATE MILLIMETRES  
DECIMALIZED NUMBERS INDICATE METRES

NO.	REVISIONS	DATE	APP.
2	AS CONSTRUCTED	MAY 88	
1	ISSUED FOR TENDER	SEPT 85	
0	ISSUED FOR CITY REVIEW	FEB 85	



W. L. WARDROP & ASSOCIATES LTD. MacLAREN ENGINEERS INC.	
DESIGNED BY: D. M.	DRAWN BY: D.B.
CHECKED BY: R. McP.	DATE: AUG. / 85
APPROVED BY: <i>[Signature]</i> DATE: <i>Sept/85</i>	

**THE CITY OF WINNIPEG**  
WORKS & OPERATIONS  
DIVISION  
WATERWORKS, WASTE &  
DISPOSAL DEPARTMENT

**NORTH END WATER POLLUTION CONTROL CENTRE  
SECONDARY TREATMENT EXPANSION  
SECONDARY CLARIFIERS - ARCHITECTURAL  
BLOWER BUILDING - MAIN FLOOR PLANS**

RELEASED FOR CONSTRUCTION DATE: *1985 09 12*  
SCALE: 1:120 DRAWING NO: **NEP 1370**



23

27

30

27

UPS ROOM

ENTRANCE TO CENTRE OF RAS GALLERY

2844 COL. 2832 COL. 400 SQ. CONC. COL.

400X838 BM. ABOVE MK B1

400X838 BM. ABOVE MK B2



APPROXIMATE SIZE/LOCATION

PLAN ABOVE ELEV. 3.795  
1:120

AS-BUILT		
DATE	FB. NO.	PAGE
MAY 85		

NO.	REVISIONS	DATE	APP.
2	AS CONSTRUCTED	MAY/88	
1	ISSUED FOR TENDER	SEPT.85	G/M
-	ISSUED FOR CLIENT APPROVAL	FEB.85	

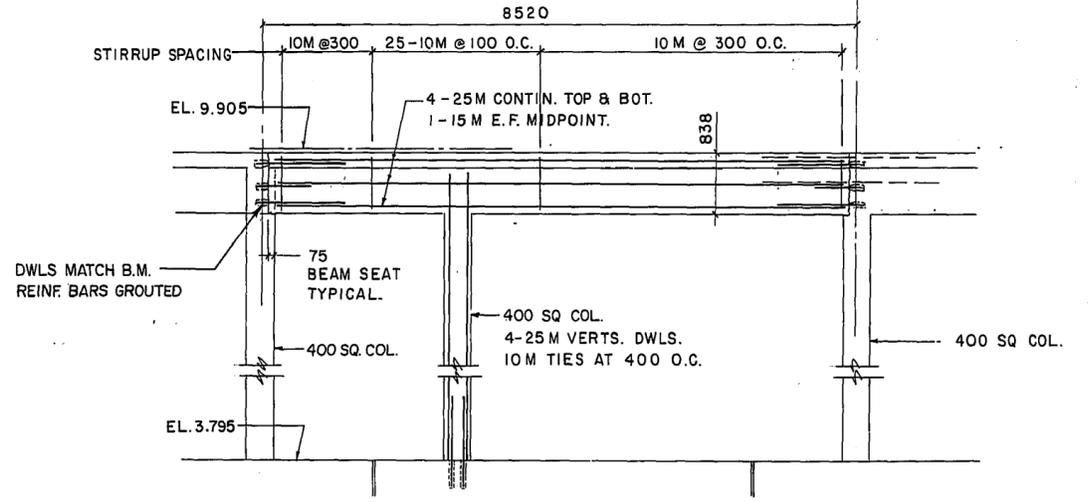


W. L. WARDROP & ASSOCIATES LTD. MacLAREN ENGINEERS INC.	
DESIGNED BY C. D.S.	DRAWN BY T.O.
CHECKED BY R. McP.	DATE AUG./85
APPROVED BY <i>[Signature]</i>	DATE Sept/85

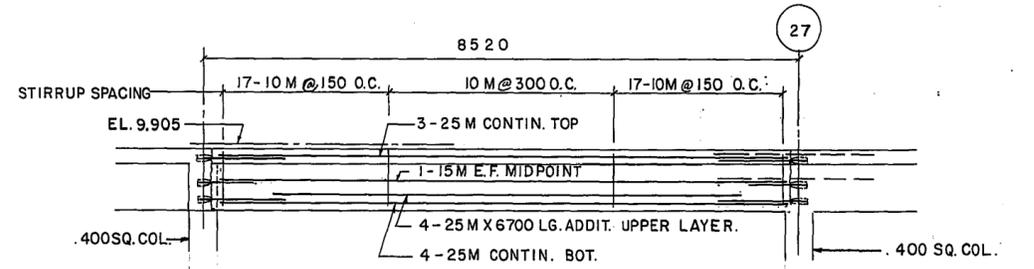
**THE CITY OF WINNIPEG**  
WORKS & OPERATIONS  
DIVISION  
WATERWORKS, WASTE & DISPOSAL DEPARTMENT

NORTH END WATER POLLUTION CONTROL CENTRE SECONDARY TREATMENT EXPANSION SECONDARY CLARIFIERS - STRUCTURAL BLOWER BUILDING - BASEMENT CONCRETE	
RELEASED FOR CONSTRUCTION <i>[Signature]</i>	DATE 1985 09 12
SCALE: AS SHOWN	DRAWING NO.: NEP 1400

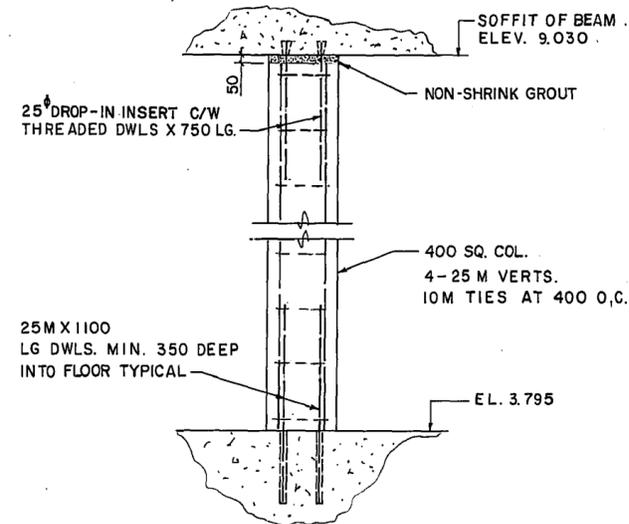
W. L. W. NO. 800012-11-16-S824



ELEVATION BEAM MK. B1  
1:50



ELEVATION BEAM MK. B2  
1:50



ELEV. COLUMNS  
ON LINE Ub  
1:20

METRIC

WHOLE NUMBERS INDICATE MILLIMETRES  
DECIMALIZED NUMBERS INDICATE METRES

**APPENDIX H - ENVIRONMENTAL MANAGEMENT POLICY**



Water and Waste Department  
Wastewater Services Division

## ENVIRONMENTAL PRESERVATION AND COMPLIANCE

### Environmental Preservation and Compliance

Working on behalf of Wastewater Services, your performance during all contracted obligations is critical to our commitment to protect the environment and comply with all environmental legislation. Please read our attached Environmental Policy.

Without limiting or otherwise affecting the generality or application of any other term or condition of the Contract, you shall, at no additional cost to the Wastewater Services Division:

- a) strictly comply with all applicable environmental laws and regulations and have suitable corrective and/or preventive measures in place to address any previous environmental warnings, fines or convictions;
- b) do or cause to be done all things required or ordered, and shall bear all costs and expenses for same, to mitigate environmental damage caused, directly or indirectly, by itself or by its servants, agents, employees or subcontractors, accidentally or as a result of practices that are or may be in contravention of the Contract or any environmental laws or regulations, or to prevent any or all of the same;
- c) ensure that all persons engaged in the performance of the Work and the Contract shall not dispose of oil or waste materials in any way which might cause pollution of land, water, lakes, rivers, streams;
- d) ensure that all persons engaged in the performance of the Work and the Contract shall follow any Safe Work Procedures provided by the contract administrator;
- e) ensure the Work, and all work sites are clean and free from fire hazards and other hazards, accumulations of waste materials, rubbish and debris;
- f) create as little waste as reasonably possible during the course of the Work and handle all waste created in the course of the Work in a environmentally preferable, and legal, manner;
- g) in respect of the Work, use all resources as efficiently and reasonably possible;
- h) the person who is responsible for a spill or who has custody and control of the substances involved in a spill must **immediately** notify the designated official (see contact list below), and must provide all information about the spill, including:
  - i) the date and time of the spill;
  - ii) the content and quantity of the spill;
  - iii) the location of the spill;
  - iv) the cause and nature of the spill;
  - v) the action completed and any work still in progress to mitigate the spill;
  - vi) the name and contact information of the person reporting the spill.
- i) the person who is responsible for a spill or who has custody and control of the substances involved in a spill must notify all appropriate regulatory agencies e.g. Fisheries and Oceans Canada, Manitoba Ministry of Sustainable Development as required by law;
- j) if a spill poses an immediate danger to human health or safety, property or the environment, the person responsible for the spill or who has custody and control of the substances involved in a spill must call 911 to report the spill;
- k) the person who is responsible for a spill or who has custody and control of the substances involved in a spill must take all reasonable measures to:
  - i) contain the spill;
  - ii) reduce the risk of harm to human health and safety, property, and the environment;
  - iii) clean up the spill and contaminated residue and dispose of spill material appropriately, and
  - iv) restore the affected area to its condition before the spill.
- l) the person who is responsible for a spill or who has custody and control of the substances involved in a spill must submit a written report to the Purchaser within five working days of the spill, containing information required to determine:
  - i) information required in (h); and
  - ii) actions necessary to reduce the effect of the spill and to prevent future spills.



Water and Waste Department  
Wastewater Services Division

## ENVIRONMENTAL PRESERVATION AND COMPLIANCE

Contact List	
<b>Federal (Winnipeg Offices)</b> Fisheries and Oceans Canada	204.983.5163
<b>Provincial</b> Manitoba Ministry of Sustainable Development	204.944.4888
<b>Wastewater Services (normal work hours)</b> Collection System Issue: Superintendent of Wastewater Collection	204.986.3492
Wastewater Treatment Plant Issue: Supervisor for NEWPCC: Supervisor for SEWPCC: Supervisor for WEWPCC:	204.986.4845 204.986.6159 204.986.5220
<b>Wastewater Services (after hours)</b> Collection System Issue: Wastewater Services Control Centre	204.986.7948
Wastewater Treatment Plant Issue:	204.794.4468



Water and Waste Department  
Wastewater Services Division

# ENVIRONMENTAL PRESERVATION AND COMPLIANCE

**Winnipeg**  
Water and Waste Department

## Environmental Management Policy

**We have an Environmental Management System (EMS) to help us manage our environmental impacts and risks, and improve our environmental performance.**

**As part of this program, we must all take responsibility for minimizing the effects of our work activities on the environment.**

**The Environmental Management System also requires that we record all operational and EMS non-conformances on the appropriate forms.**

The Water and Waste Department's sewage treatment facilities, and wastewater collection and land drainage systems, aim to achieve excellence in environmental services, pollution prevention, and protection of public health through a commitment to continually improving the Environmental Management System.

**We are committed to:**

1. Understanding and respecting the views of our customers, employees, communities and stakeholders when planning and undertaking our activities.
2. Remaining current with advancing and innovative technology and management practices in our facilities.
3. Ensuring awareness, training and involvement of all staff to enable them to conduct their work in an environmentally responsible manner and to play a full role in continual improvement.
4. Aiming for best performance and sustainability in all aspects of our business to ensure compliance, at the highest level, with legislative requirements and our own standards.
5. Reviewing our environmental objectives and targets annually to ensure improvement in our environmental performance.

  
Director, Water and Waste Department

December 2011

**APPENDIX I - CITY OF WINNIPEG FORMS**



---

**Form 100**  
**CERTIFICATE OF EQUIPMENT DELIVERY**

---

We certify that the equipment listed below has been delivered into the care and custody of the Installation Contractor. The equipment has been found to be in satisfactory condition. There is no visible evidence of exterior damage or defects.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

---

(Authorized Representative of Supply Contractor)

---

Date

---

(Authorized Representative of Install Contractor)

---

Date

---

(Authorized Representative of Contract Administrator)

---

Date



---

**Form 101**  
**CERTIFICATE OF READINESS TO INSTALL**

---

We have familiarized the installing contractor of the specific requirements related to the equipment listed below and am satisfied that the installing contractor understands the required installation procedures.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

---

(Authorized Representative of Supply Contractor)

---

Date

We certify that we have received satisfactory installation instructions from the equipment manufacturer/vendor.

---

(Authorized Representative of Install Contractor)

---

Date



---

**Form 102**  
**CERTIFICATE OF SATISFACTORY INSTALLATION**

---

We have completed our checks and inspection of the installation of our equipment as listed below and confirm that it is satisfactory and that any defects have been remedied except any as noted below.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

**Outstanding Defects:**

\_\_\_\_\_  
(Authorized Representative of Supply Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Install Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Contractor Administrator)

\_\_\_\_\_  
Date



---

**Form 103**

**CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE**

---

We certify that the equipment listed below has been continuously operated for a minimum of three (3) consecutive days and that the equipment operates satisfactorily and meets its specified operating criteria. No defects in the equipment were found and as such are classified as "conforming".

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

\_\_\_\_\_  
(Authorized representative of Supply Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized representative of Install Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized representative of Contract Administrator)

\_\_\_\_\_  
Date



---

**Form 104**

**CERTIFICATE OF SATISFACTORY PROCESS PERFORMANCE**

---

We certify that the process system listed below has been continuously operated and tested as per the Specifications using process fluid and that the equipment meets its Performance Testing and Operating Criteria. No defects in the process system were found and as such are classified as “conforming”.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

\_\_\_\_\_  
(Authorized Representative of Supply Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Install Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Contract Administrator  
i.e. Commissioning Lead or Design Discipline Lead)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of City)

\_\_\_\_\_  
Date

**APPENDIX J – QUALIFICATION DATA REQUIREMENTS**

**ASME PCC-2-2015**

**Table 1 Repair System Required Material and Performance Properties**

Property	Test Type	Detail Properties	Minimum Values	Test Methods	Product Data	Product Data Units	Design Values	Design Value Units
<b>Tensile strength (<math>S_{u1}</math>, <math>S_{u2}</math>) and tensile modulus (<math>E_c</math>)</b>	Mandatory	<b>Primary Properties</b> Tensile strength ( $s$ ), modulus ( $E$ ), Poisson's ratio (for leaking pipes and some design cases; strain to failure in both hoop and axial directions)	Strain to failure must be >1%	ISO 527, ASTM D3039		N/m <sup>2</sup> (psi)		N/m <sup>2</sup> (psi)
<b>In-plane shear modulus</b>	Mandatory for leaking pipes only	Modulus only ( $G_{11}$ )	None	ASTM D5379		N/m <sup>2</sup> (psi)		N/m <sup>2</sup> (psi)
<b>Per ply thickness</b>	Mandatory	Thickness per ply	None	None (may be determined from the tensile tests above)		mm (in.)		mm (in.)
<b>Hardness</b>	Mandatory	Barcol or Shore hardness data	None	BS EN 59, ISO 868, ASTM D2583, ASTM D2240		Rating		Rating
<b>Coefficient of thermal expansion</b>	Mandatory	CTE value	None	ISO 11359-2, ASTM E831		°C <sup>-1</sup> (°F <sup>-1</sup> )		°C <sup>-1</sup> (°F <sup>-1</sup> )
<b>Glass transition temperature (<math>T_g</math>)</b>	Mandatory or use HDT below	Glass transition temperature ( $T_g$ )	None, except that this can determine the maximum operating temperature of the composite system	ISO 11357-2, ASTM E831, ASTM E1640, ASTM E6604		°C (°F)		°C (°F)
<b>Heat distortion temperature (HDT) [Note (1)]</b>	Mandatory or use $T_g$ above	Heat distortion temperature (HDT)	None, except that this can determine the maximum operating temperature of the composite system	ISO 75, ASTM D648		°C (°F)		°C (°F)
<b>Lap shear adhesion strength [Note (2)]</b>	Mandatory	Shear strength of composite bond to substrate	4 MN/m <sup>2</sup> (580 psi)	BS EN 1465, ASTM D3165, ASTM D5868		N/m <sup>2</sup> (psi)		N/m <sup>2</sup> (psi)
<b>Impact performance</b>	Mandatory for leaking pipes only	Low velocity impact performance	Withstand drop test per Mandatory Appendix VI	Mandatory Appendix VI		Pass/Fail		Pass/Fail
<b>Energy release rate (<math>\gamma</math>)</b>	Mandatory for leaking pipes only	Toughness parameter, energy release rate ( $\gamma$ )	None	Mandatory Appendix IV		J/m <sup>2</sup> (in.-lb/in <sup>2</sup> )		J/m <sup>2</sup> (in.-lb/in <sup>2</sup> )
<b>Long-term lap shear performance</b>	Optional	Measurement of lap shear strength after 1,000-hr heat exposure	30% of lap shear adhesion strength	Mandatory Appendix II 2		N/m <sup>2</sup> (psi)		N/m <sup>2</sup> (psi)
<b>Structural strengthening</b>	Mandatory	Wrapped pipe with defect must withstand a short-term pressure test	Warp must not fail	Mandatory Appendix III		Pass/Fail		Pass/Fail
<b>Long-term strength [Note (3)]</b>	Optional	Determine long-term (creep-rupture) strength of the wrap by either of three methods	None [Note (4)]	Mandatory Appendix V, ASTM D2990, ASTM D2992		N/m <sup>2</sup> (psi)		N/m <sup>2</sup> (psi)
<b>Cathodic disbondment</b>	Mandatory for cathodically protected pipes	Disbondment	None	ASTM G8, ASTM G42, ASTM G95		Pass/Fail		Pass/Fail
<b>Cyclic loading</b>	Optional	None	None	ISO 14692, ISO 24817		-		-
<b>Electrical conductivity</b>	Optional	None	None	ISO 14692, ASTM D149		S/m		S/m
<b>Chemical compatibility</b>	Optional	None	None	ASTM D543, ASTM C581, ASTM D3681, ISO 10952		Pass/Fail (owner determines standard)		Pass/Fail (owner determines standard)
<b>Compressive modulus</b>	Mandatory	Load transfer material	None	ASTM D695, ASTM D6641, ISO 604, ISO 14126		MPa/mm (psi/in)		MPa/mm (psi/in)

**NOTES:**

(1) For the matrix polymer (without the reinforcing fibers), use ASTM D648 to measure HDT under load of 1.82MPa (264 psi). As an alternative, when measuring HDT for reinforced polymers, the minimum load should be 18MPa (2,640 psi).

(2) When using ASTM D3165, ASTM D5868, or BS EN 1465, it shall serve to provide general guidelines for this test. A sample of the composite instead of just the adhesive should be used.

(3) When using ASTM D2990 and ASTM D2992, they shall serve to provide general guidelines for this test.

(4) This test qualifies the wrap pursuant to Table 5.

**APPENDIX K – PROCESS DATA**





**APPENDIX L - LISTS**



Project Name: North End Sewage Treatment Plant (NEWPC) Return Activated Sludge (RAS) Piping Refurbishment  
 Project Number: 21-0107-001  
 Client: City of Winnipeg  
 Document No: LST-E-001\_Instrument List  
 Date: September 16, 2021  
 Revision: 0

Rev.	Return Activated Sludge	Instrument Tag	Instrument Type	Manufacture	Existing Model Number	Manufacture	New Model Number	Control Panel	Power Source	Description	Status (Replace, Remove)	Location
0	3B Pipe	RB35-FE-3B	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 3B, Secondary Control Room	Panel H, Reactor Electrical Room	West side of the Return activated Sludge 3	Replace	In-line with Return Activated Sludge 3B Pipe
0		RB35-FIT-3B	Flow	FOXBORO	E965-1B-C	Siemens	MAG 6000-7ME6920-2PA1D-1AA0	Instrument Rack 3B, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	Panel beside the Primary Effluent
0		RB35-FG-3B	Ultrasonic General	FOXBORO	A2040US		Not Required	Instrument Rack 3B, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Remove	Panel beside the Primary Effluent
0	3A Pipe	Missing Tag (RB30)	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 3A, Secondary Control Room	Panel H, Reactor Electrical Room	East side of the Return activated Sludge 3	Replace	In-line with Return Activated Sludge 3A Pipe
0		RB30-FIT-3A	Flow	FOXBORO	E965-1B-C	Siemens	MAG 6000-7ME6920-2PA1D-1AA0	Instrument Rack 3A, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	West side of the Primary effluent 3A pipe
0		RB30-FG-3A	Ultrasonic General	FOXBORO	A2040US		Not Required	Instrument Rack 3A, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Remove	West side of the Primary effluent 3A pipe
0	2B Pipe	RB25-FE-2B	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 2B, Secondary Control Room	Panel H, Reactor Electrical Room	West side of the Return activated Sludge 2	Replace	In-line with Return activated Sludge 2B Pipe
0		RB25-FIT-2B	Flow	FOXBORO	E965-1B-C	Siemens	MAG 6000-7ME6920-2PA1D-1AA0	Instrument Rack 2B, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	West side of the Primary effluent 2B pipe
0		RB25-FG-2B	Ultrasonic General	FOXBORO	A2040US		Not Required	Instrument Rack 2B, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Remove	West side of the Primary effluent 2B pipe
0	2A Pipe	RB20-FE-2A	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 2A, Secondary Control Room	Panel H, Reactor Electrical Room	East side of the Return activated Sludge 2	Replace	In-line with Return Activated Sludge 2A Pipe
0		RB20-FIT-2A	Flow	FOXBORO	E965-1B-C	Siemens	MAG 6000-7ME6920-2PA1D-1AA0	Instrument Rack 2A, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	West side of the Primary effluent 2A pipe
0		RB20-FG-2A	Ultrasonic General	FOXBORO	A2040US		Not Required	Instrument Rack 2A, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Remove	West side of the Primary effluent 2A pipe
0	1B Pipe	RB15-FV-1B	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 1B, Secondary Control Room	Panel H, Reactor Electrical Room	West side of the Return activated Sludge 1	Replace	In-line with Return activated Sludge 1B Pipe
0		RB15-FIT-1B	Flow	FOXBORO	IMT96-SECT1B10-AB	Siemens	MAG 6000-7ME6920-2PA1D-1AA0	Instrument Rack 1B, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	West side of the Primary effluent 1B pipe
0		RB15-FG-1B	Ultrasonic General	FOXBORO	A2040US		Not Required	Instrument Rack 1B, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Remove	West side of the Primary effluent 1B pipe
0	1A Pipe	RB10-FE-1A	Flow Meter	FOXBORO	2820-SEBA-AS	Siemens	MAG3100-7ME63104H112AA2	Instrument Rack 1A, Secondary Control Room	Panel H, Reactor Electrical Room	East side of the Return activated Sludge 1	Replace	In-line with Return Activated Sludge 1A Pipe
0		Missing Tag(RB10-FIT-1A)	Flow	FOXBORO	E965-1B-C	Siemens	MAG 6000-7ME6920-2PA1D-1AA0	Instrument Rack 1A, Secondary Control Room	Panel H, Reactor Electrical Room	Return Activated Sludge Flow	Replace	West side of the Primary effluent 1A pipe
0		RB10-FG-1A	Ultrasonic General	FOXBORO	A2040US		Not Required	Instrument Rack 1A, Secondary Control Room	Panel H, Reactor Electrical Room	Flow Meter Ultrasonic Oscillator	Remove	West side of the Primary effluent 1A pipe
0	WAS Header 1	S941-FE	Flow Meter	FISCHER & PORTER	10D1435A/U	Siemens	MAG3100-7ME63104H112AA2	Secondary Control Room	Panel FDP-B4, Secondaries Control Room	Flowmeter For WAS HEADER 1	Replace	In-line with WAS HEADER 1 (WAS TRN 3)
0		S941-FG	meter Ultrasonic	FISCHER & PORTER	55UC2210A		Not Required	Secondary Control Room	Panel FDP-B4, Secondaries Control Room	Magnetometer Ultrasonic Generator For WAS HEADER 1	Remove	Beside WAS HEADER 1 (WAS TRN 3)
0		S941-FIT	Flow Transmitter	FISCHER & PORTER	50PZ10006	Siemens	MAG 6000-7ME6920-2PA1D-1AA0	Secondary Control Room	Panel FDP-B4, Secondaries Control Room	Flow Transmitter For WAS HEADER 1	Replace	Beside WAS HEADER 1 (WAS TRN 3)
0	WAS Header 2	S942-FE	Flow Meter	FISCHER & PORTER	10D1435A/U	Siemens	MAG3100-7ME63104H112AA2	Secondary Control Room	Panel FDP-B4, Secondaries Control Room	Flowmeter For WAS HEADER 2	Replace	In-line with WAS HEADER 2 (WAS TRN 2)
0		S942-FG	meter Ultrasonic	FISCHER & PORTER	55UC2210A		Not Required	Secondary Control Room	Panel FDP-B4, Secondaries Control Room	Magnetometer Ultrasonic Generator For WAS HEADER 2	Remove	Beside WAS HEADER 2 (WAS TRN 2)
0		S942-FIT	Flow Transmitter	FISCHER & PORTER	50PZ10006	Siemens	MAG 6000-7ME6920-2PA1D-1AA0	Secondary Control Room	Panel FDP-B4, Secondaries Control Room	Flow Transmitter For WAS HEADER 2	Replace	Beside WAS HEADER 2 (WAS TRN 2)
0	WAS Header 3	S943-FE	Flow Meter	FISCHER & PORTER	10D1435A/U	Siemens	MAG3100-7ME63104H112AA2	Secondary Control Room	Panel FDP-B4, Secondaries Control Room	Flowmeter For WAS HEADER 3	Replace	In-line with WAS HEADER 3 (WAS TRN 1)
0		S943-FG	meter Ultrasonic	FISCHER & PORTER	55UC2210A		Not Required	Secondary Control Room	Panel FDP-B4, Secondaries Control Room	Magnetometer Ultrasonic Generator For WAS HEADER 3	Remove	Beside WAS HEADER 3 (WAS TRN 1)
0		S943-FIT	Flow Transmitter	FISCHER & PORTER	50PZ10006	Siemens	MAG 6000-7ME6920-2PA1D-1AA0	Secondary Control Room	Panel FDP-B4, Secondaries Control Room	Flow Transmitter For WAS HEADER 3	Replace	Beside WAS HEADER 3 (WAS TRN 1)

## Leak Locations List

0	2021-09-16	ISSUED FOR TENDER	AJF	JS
Revision	Date	Issued For	By	Approved
<b>City of Winnipeg</b>				
North End Sewage Treatment Plant (NEWPCC) Return Activated Sludge (RAS) Piping Refurbishment				
<b>Document Number</b>	LST-M-001_Leak Locations	<b>Revision</b>	0	

**Project Name:** North End Sewage Treatment Plant (NEWPCC) Return Activated Sludge (RAS) Piping Refurbishment

**Project Number:** 21-0107-001

**Client:** City of Winnipeg

**Document No:** LST-M-001\_Leak Locations

**Date:** September 16, 2021

**Revision:** 0

Leak Locations							
REV.	TAG	ITEM NO.	RAS LOCATION	REFERENCE	DESCRIPTION	TEMP. REPAIR	COMMENTS
0	LK-1-001	001	1	LK-1-001	Beginning of elbow immediately prior to PSE-1.02.49, after RAS 1 and RAS 3 split	N	
0	LK-1-002	002	1	LK-1-002	Immediately after PSE-1.02.40	N	
0	LK-1-003	003	1	LK-1-003	Near PSE-1.02.39	N	
0	LK-1-004	004	1	LK-1-004	Immediately before M-VALVE-MANUAL-S907-HV4-7	Y	
0	LK-1-005	005	1	LK-1-005	Immediately before M-VALVE-MANUAL-S905-HV4-5	N	
0	LK-1-006	006	1	LK-1-006	Immediately before M-VALVE-MANUAL-S906-HV4-6	N	
0	LK-1-007	007	1	LK-1-007	Near PSE-1.02.11	N	
0	LK-1-008	008	1	LK-1-008	At elbow near PSE-3.04.09	N	
0	LK-1-009	009	1	LK-1-009	Near PSE-1.04.13	N	
0	LK-2-001	001	2	LK-2-001	At elbow below M-VALVE-MANUAL-R820-KV-2A	N	
0	LK-2-002	002	2	LK-2-002	Bend before PSE-2.03.05	N	
0	LK-2-003	003	2	LK-2-003	Immediately before M-VALVE-MANUAL-S911-HV4-11	N	
0	LK-2-004	004	2	LK-2-004	Immediately before M-VALVE-MANUAL-S915-HV4-15	Y	
0	LK-2-005	005	2	LK-2-005	Immediately before M-VALVE-MANUAL-S915-HV4-16	N	
0	LK-2-006	006	2	LK-2-006	Immediately before M-VALVE-MANUAL-S917-HV4-17	N	
0	LK-3-001	001	3	LK-3-001	At Manual Valve HPV-3.01	N	
0	LK-3-002	002	3	LK-3-002	At elbow near PSE-3.04.02	Y	
0	LK-3-003	003	3	LK-3-003	At elbow near PSE-3.04.01	N	
0	LK-3-004	004	3	LK-3-004	At elbow near Manual Valve LPD-3.03	Y	
0	LK-3-005	005	3	LK-3-005	Immediately before M-VALVE-MANUAL-S920-HV4-20	Y	
0	LK-3-006	006	3	LK-3-006	Immediately before M-VALVE-MANUAL-S921-HV4-21	Y	
0	LK-3-007	007	3	LK-3-007	Immediately before M-VALVE-MANUAL-S923-HV4-23	N	
0	LK-3-008	008	3	LK-3-008	Immediately before PSE-3.01.08	N	
0	LK-3-009	009	3	LK-3-009	Immediately before M-VALVE-MANUAL-S924-HV4-24	Y	
0	LK-3-010	010	3	LK-3-010	HPO Gallery - before elbow to floor penetration	N	



**Project Name:** North End Sewage Treatment Plant (NEWPCC) Return Activated Sludge (RAS) Piping Refurbishment  
**Project Number:** 21-0107-001  
**Client:** City of Winnipeg  
**Document No:** LST-M-002\_Pipe Supports  
**Date:** September 16, 2021  
**Revision:** 0

PIPING SYSTEM	
TYPE	DESCRIPTION
01	RAS TRAIN NO. 1
02	RAS TRAIN NO. 2
03	RAS TRAIN NO. 3
04	WAS SYSTEM

LEGEND	
TYPE	DESCRIPTION
01	STAND PIPE
02	WALL BRACKET
03	CONCRETE SADDLE
04	MISC. SUPPORT
05	STEEL PEDESTAL

NEWPCC RAS PIPING SUPPORTS LIST

REV.	TAG # (note 3)*	EXISTING (E) NEW (N)	PIPING SYSTEM	TYPE	SUPPORT NO.	PIPE DIA. (mm)	Weight of pipe (filled w/ sludge) (kN) (note 1)*	Dist. CL Pipe to F/O Wall (mm) (note 2)*	Cable Tray Support	T/O Tray Support EL. (m) (note 2)*	PIPE CL ELEVATION		GRID		REFERENCE DWG #	COMMENTS
											MEASURED. (m) (note 2)*	DESIGN. (m)	US	DS		
0	PSE-1.02.01	E	1	02	01	450	6.7		No		3.747	3.625	54	50		
0	PSE-1.02.02	E	1	02	02	500	8.0		No		4.795	4.800	50	47		
0	PSE-1.02.03	E	1	02	03	500	8.0		No		4.795	4.800	50	47		
0	PSE-1.02.04	E	1	02	04	500	8.0		No		4.795	4.800	50	47		
0	PSE-1.02.05	E	1	02	05	500	8.0		No		4.795	4.800	46	43		
0	PSE-1.02.06	E	1	02	06	500	8.0		No		4.795	4.800	46	43		
0	PSE-1.02.07	E	1	02	07	600	10.9		No		4.795	4.800	46	43		
0	PSE-1.02.08	E	1	02	08	600	10.9		No		4.795	4.800	46	43		
0	PSE-1.02.09	E	1	02	09	600	10.9		No		4.795	4.800	43	40		
0	PSE-1.02.10	E	1	02	10	600	10.9		No		4.795	4.800	43	40		
0	PSE-1.02.11	E	1	02	11	600	10.9		No		4.795	4.800	43	40		
0	PSE-1.02.12	E	1	02	12	600	10.9		No		4.795	4.800	43	40		
0	PSE-1.02.13	E	1	02	13	600	10.9		No		4.795	4.800	40	37		
0	PSE-1.02.14	E	1	02	14	600	10.9		No		4.795	4.800	40	37		
0	PSE-1.02.15	E	1	02	15	600	10.9		No		4.795	4.800	40	37		
0	PSE-1.02.16	E	1	02	16	600	10.9		No		4.795	4.800	40	37		
0	PSE-1.02.17	E	1	02	17	600	10.9		No		4.795	4.800	37	34		
0	PSE-1.02.18	E	1	02	18	600	10.9		No		4.795	4.800	37	34		
0	PSE-1.02.19	E	1	02	19	600	10.9		No		4.795	4.800	37	34		
0	PSE-1.02.20	E	1	02	20	600	10.9		No		4.795	4.800	37	34		
0	PSE-1.02.21	E	1	02	21	600	10.9		No		4.795	4.800	33	29		
0	PSE-1.02.22	E	1	02	22	600	10.9		No		5.246	5.200	26	24		
0	PSE-1.02.23	E	1	02	23	600	10.9		No		5.246	5.200	26	24		
0	PSE-1.02.24	E	1	02	24	600	10.9		No		5.246	5.200	26	24		
0	PSE-1.02.25	E	1	02	25	600	10.9		No		5.246	5.200	26	24		
0	PSE-1.02.26	E	1	02	26	600	10.9		No		5.246	5.200	26	24		
0	PSE-1.02.27	E	1	02	27	600	10.9		No		5.246	5.200	24	19		
0	PSE-1.02.28	E	1	02	28	600	10.9		No		5.246	5.200	24	19		
0	PSE-1.02.29	E	1	02	29	750	16.1		No		5.246	5.200	24	19		
0	PSE-1.02.30	E	1	02	30	750	16.1		No		5.246	5.200	24	19		
0	PSE-1.02.31	E	1	02	31	750	16.1		No		5.246	5.200	18	15		
0	PSE-1.02.32	E	1	02	32	750	16.1		No		5.246	5.200	18	15		
0	PSE-1.02.33	E	1	02	33	750	16.1		No		5.246	5.200	18	15		
0	PSE-1.02.34	E	1	02	34	750	16.1		No		5.246	5.200	18	15		
0	PSE-1.02.35	E	1	02	35	750	16.1		No		5.246	5.200	15	12		
0	PSE-1.02.36	E	1	02	36	750	16.1		No		5.246	5.200	15	12		
0	PSE-1.02.37	E	1	02	37	750	16.1		No		5.246	5.200	15	12		
0	PSE-1.02.38	E	1	02	38	750	16.1		No		5.246	5.200	15	12		
0	PSE-1.02.39	E	1	02	39	750	16.1		No		5.246	5.200	15	12		
0	PSE-1.02.40	E	1	02	40	750	16.1		No		5.246	5.200	12	9		
0	PSE-1.02.41	E	1	02	41	750	16.1		No		5.246	5.200	12	9		
0	PSE-1.02.42	E	1	02	42	750	16.1		No		5.246	5.200	12	9		
0	PSE-1.02.43	E	1	02	43	900	22.1		No		5.246	5.200	12	9		
0	PSE-1.02.44	E	1	02	44	900	22.1		No		5.246	5.200	9	6		
0	PSE-1.02.45	E	1	02	45	900	22.1		No		5.246	5.200	9	6		
0	PSE-1.02.46	E	1	02	46	900	22.1		No		5.246	5.200	9	6		
0	PSE-1.02.47	E	1	02	47	900	22.1		No		5.246	5.200	9	6		

NEWPCC RAS PIPING SUPPORTS LIST

REV.	TAG # (note 3)*	EXISTING (E) NEW (N)	PIPING SYSTEM	TYPE	SUPPORT NO.	PIPE DIA. (mm)	Weight of pipe (filled w/ sludge) (kN) (note 1)*	Dist. CL Pipe to F/O Wall (mm) (note 2)*	Cable Tray Support	T/O Tray Support EL. (m) (note 2)*	PIPE CL ELEVATION		GRID		REFERENCE DWG #	COMMENTS
											MEASURED. (m) (note 2)*	DESIGN. (m)	US	DS		
0	PSE-1.02.48	E	1	02	48	900	22.1		No		5.246	5.200	6	1A		
0	PSE-1.02.49	E	1	02	49	900	22.1		No		5.246	5.200	6	1A		
0	PSE-1.02.50	E	1	02	50	500	8.0		No		5.500	5.250	1A	2A		
0	PSE-1.02.51	E	1	02	51	500	8.0		No		5.500	5.250	1A	2A		
0	PSE-1.03.01	E	1	03	01	900	22.1		No		2.813	2.775	1A	2A		
0	PSE-1.03.02	E	1	03	02	900	22.1		No		2.813	2.775	1A	2A		
0	PSE-1.03.03	E	1	03	03	900	22.1		No		2.813	2.775	1A	2A		
0	PSE-1.03.04	E	1	03	04	900	22.1		No		2.813	2.775	1A	2A		
0	PSE-1.04.01	E	1	04	01	450	6.7		No		3.747	3.625	54	50		
0	PSE-1.04.02	E	1	04	02	450	6.7		No		2.354	2.400	54	50		
0	PSE-1.04.03	E	1	04	03	450	6.7		No		2.354	2.400	54	50		
0	PSE-1.04.04	E	1	04	04	600	10.9		No		2.141	2.350	33	29		
0	PSE-1.04.05	E	1	04	05	600	10.9		No		2.141	2.350	33	29		
0	PSE-1.04.06	E	1	04	06	600	10.9		No		2.141	2.350	29	26		
0	PSE-1.04.07	E	1	04	07	600	10.9		No		2.141	2.350	29	26		
0	PSE-1.04.08	E	1	04	08	900	22.1		No		1.330	1.350	9	6		
0	PSE-1.04.09	E	1	04	09	900	22.1		No		1.320	1.350	1A	2A		
0	PSE-1.04.10	E	1	04	10	900	22.1		No		5.246	5.200	1A	2A		
0	PSE-1.04.11	E	1	04	11	900	22.1		No		5.246	5.200	1A	2A		
0	PSE-1.04.12	E	1	04	12	900	22.1		No		2.813	2.775	1A	2A		
0	PSE-1.04.13	E	1	04	13	900	22.1		No		2.813	2.775	1A	2A		
0	PSE-1.04.14	E	1	04	14	900	22.1		No		5.500	5.250	1A	2A		
0	PSE-1.04.15	E	1	04	15	900	22.1		No		5.500	5.250	1A	2A		
0	PSE-1.04.16	E	1	04	16	900	22.1		No		5.500	5.250	1A	2A		
0	PSE-2.01.01	E	2	01	01	300	4.0		No	2.593	2.641	2.600	29	26		
0	PSE-2.01.02	E	2	01	02	300	4.0		No	2.593	2.641	2.600	29	26		
0	PSE-2.01.03	E	2	01	03	450	6.7		No		3.867	3.750	26	24		
0	PSE-2.01.04	E	2	01	04	450	6.7		No		3.867	3.750	26	24		
0	PSE-2.01.05	E	2	01	05	450	6.7		No		3.867	3.750	26	24		
0	PSE-2.01.06	E	2	01	06	600	10.9		No		3.867	3.750	26	24		
0	PSE-2.01.07	E	2	01	07	600	10.9		No		3.867	3.750	24	19		
0	PSE-2.01.08	E	2	01	08	600	10.9		No		3.867	3.750	24	19		
0	PSE-2.01.09	E	2	01	09	750	16.1		No		3.867	3.750	24	19		
0	PSE-2.01.10	E	2	01	10	750	16.1		Yes	2.157	3.867	3.750	18	15		
0	PSE-2.01.11	E	2	01	11	750	16.1		Yes	2.157	3.867	3.750	18	15		
0	PSE-2.01.12	E	2	01	12	750	16.1		Yes	2.157	3.867	3.750	18	15		
0	PSE-2.01.13	E	2	01	13	750	16.1		Yes	2.157	3.867	3.750	18	15		
0	PSE-2.01.14	E	2	01	14	750	16.1		Yes	2.157	3.867	3.750	18	15		
0	PSE-2.01.15	E	2	01	15	750	16.1		Yes	2.157	3.867	3.750	15	12		
0	PSE-2.01.16	E	2	01	16	750	16.1		Yes	2.157	3.867	3.750	15	12		
0	PSE-2.01.17	E	2	01	17	750	16.1		Yes	2.157	3.867	3.750	15	12		
0	PSE-2.01.18	E	2	01	18	750	16.1		Yes	2.157	3.867	3.750	15	12		
0	PSE-2.01.19	E	2	01	19	900	22.1		Yes	2.157	3.867	3.750	12	9		
0	PSE-2.01.20	E	2	01	20	900	22.1		Yes	2.157	3.867	3.750	12	9		
0	PSE-2.01.21	E	2	01	21	900	22.1		Yes	2.157	3.867	3.750	12	9		
0	PSE-2.01.22	E	2	01	22	900	22.1		Yes	2.157	3.867	3.750	12	9		
0	PSE-2.01.23	E	2	01	23	900	22.1		Yes	2.157	3.867	3.750	12	9		
0	PSE-2.01.24	E	2	01	24	900	22.1		Yes	2.157	3.867	3.750	9	6		
0	PSE-2.01.25	E	2	01	25	900	22.1		Yes	2.157	3.867	3.750	9	6		
0	PSE-2.02.01	E	2	02	01	900	22.1		No		3.867	3.750	9	6		
0	PSE-2.02.02	E	2	02	02	900	22.1		No		5.284	5.250	2B	3A		
0	PSE-2.02.03	E	2	02	03	900	22.1		No		5.284	5.250	2B	3A		
0	PSE-2.03.01	E	2	03	01	900	22.1		No		1.330	1.350	9	6		
0	PSE-2.03.02	E	2	03	02	900	22.1		No		1.330	1.350	6	1A		
0	PSE-2.03.03	E	2	03	03	900	22.1		No		1.330	1.350	6	1A		

NEWPCC RAS PIPING SUPPORTS LIST

REV.	TAG # (note 3)*	EXISTING (E) NEW (N)	PIPING SYSTEM	TYPE	SUPPORT NO.	PIPE DIA. (mm)	Weight of pipe (filled w/ sludge) (kN) (note 1)*	Dist. CL Pipe to F/O Wall (mm) (note 2)*	Cable Tray Support	T/O Tray Support EL. (m) (note 2)*	PIPE CL ELEVATION		GRID		REFERENCE DWG #	COMMENTS
											MEASURED. (m) (note 2)*	DESIGN. (m)	US	DS		
0	PSE-2.03.04	E	2	03	04	900	22.1		No		1.330	1.350	1A	1B		
0	PSE-2.03.05	E	2	03	05	900	22.1		No		1.330	1.350	1A	1B		
0	PSE-2.04.01	E	2	04	01	900	22.1		No		5.284	5.250	2B	3A		
0	PSE-2.04.02	E	2	04	02	900	22.1		No		5.284	5.250	2B	3A		
0	PSE-2.04.03	E	2	04	03	900	22.1		No		1.330	1.350	9	6		
0	PSE-3.01.01	E	3	01	01	300	4.0		Yes	2.720	3.762	3.750	57	54		
0	PSE-3.01.02	E	3	01	02	300	4.0		Yes	2.720	3.762	3.750	57	54		
0	PSE-3.01.03	E	3	01	03	300	4.0		Yes	2.720	3.762	3.750	57	54		
0	PSE-3.01.04	E	3	01	04	450	6.7		Yes	2.720	3.762	3.750	54	50		
0	PSE-3.01.05	E	3	01	05	450	6.7		Yes	2.720	3.762	3.750	54	50		
0	PSE-3.01.06	E	3	01	06	450	6.7		Yes	2.720	3.762	3.750	54	50		
0	PSE-3.01.07	E	3	01	07	600	10.9		Yes	2.720	2.279	2.400	54	50		
0	PSE-3.01.08	E	3	01	08	600	10.9		Yes	2.720	3.739	3.750	50	47		
0	PSE-3.01.09	E	3	01	09	600	10.9		Yes	2.720	3.739	3.750	50	47		
0	PSE-3.01.10	E	3	01	10	600	10.9		Yes	2.720	3.739	3.750	50	47		
0	PSE-3.01.11	E	3	01	11	600	10.9		Yes	2.720	3.739	3.750	50	47		
0	PSE-3.01.12	E	3	01	12	750	16.1		Yes	2.720	3.739	3.750	50	47		
0	PSE-3.01.13	E	3	01	13	750	16.1		Yes	2.720	3.739	3.750	50	47		
0	PSE-3.01.14	E	3	01	14	750	16.1		Yes	2.720	3.739	3.750	46	43		
0	PSE-3.01.15	E	3	01	15	750	16.1		Yes	2.720	3.739	3.750	46	43		
0	PSE-3.01.16	E	3	01	16	750	16.1		Yes	2.720	3.739	3.750	46	43		
0	PSE-3.01.17	E	3	01	17	750	16.1		Yes	2.720	3.739	3.750	46	43		
0	PSE-3.01.18	E	3	01	18	750	16.1		Yes	2.720	3.739	3.750	46	43		
0	PSE-3.01.19	E	3	01	19	750	16.1		Yes	2.720	3.739	3.750	43	40		
0	PSE-3.01.20	E	3	01	20	750	16.1		Yes	2.720	3.739	3.750	43	40		
0	PSE-3.01.21	E	3	01	21	750	16.1		Yes	2.720	3.739	3.750	43	40		
0	PSE-3.01.22	E	3	01	22	750	16.1		Yes	3.082	3.739	3.750	43	40		
0	PSE-3.01.23	E	3	01	23	750	16.1		Yes	3.082	3.739	3.750	40	37		
0	PSE-3.01.24	E	3	01	24	900	22.1		Yes	3.082	3.739	3.750	40	37		
0	PSE-3.01.25	E	3	01	25	900	22.1		Yes	3.082	3.739	3.750	40	37		
0	PSE-3.01.26	E	3	01	26	900	22.1		Yes	3.082	3.739	3.750	40	37		
0	PSE-3.01.27	E	3	01	27	900	22.1		Yes	3.082	3.739	3.750	40	37		
0	PSE-3.01.28	E	3	01	28	900	22.1		Yes	2.645	3.739	3.750	37	34		
0	PSE-3.01.29	E	3	01	29	900	22.1		Yes	2.645	3.739	3.750	37	34		
0	PSE-3.01.30	E	3	01	30	900	22.1		Yes	2.645	3.739	3.750	37	34		
0	PSE-3.01.31	E	3	01	31	900	22.1		Yes	2.645	3.739	3.750	37	34		
0	PSE-3.01.32	E	3	01	32	900	22.1		Yes	2.645	3.739	3.750	33	29		
0	PSE-3.01.33	E	3	01	33	900	22.1		Yes	2.645	3.739	3.750	33	29		
0	PSE-3.01.34	E	3	01	34	900	22.1		Yes	2.720	3.739	3.750	33	29		
0	PSE-3.01.35	E	3	01	35	900	22.1		No		3.739	3.750	29	26		
0	PSE-3.01.36	E	3	01	36	900	22.1		Yes	2.645	3.739	3.750	29	26		
0	PSE-3.01.37	E	3	01	37	900	22.1		Yes	2.645	3.739	3.750	29	26		
0	PSE-3.01.38	E	3	01	38	900	22.1		Yes	2.645	3.739	3.750	26	24		
0	PSE-3.01.39	E	3	01	39	900	22.1		Yes	2.645	3.739	3.750	26	24		
0	PSE-3.01.40	E	3	01	40	900	22.1		Yes	2.645	3.739	3.750	26	24		
0	PSE-3.01.41	E	3	01	41	900	22.1		Yes	2.645	3.739	3.750	26	24		
0	PSE-3.01.42	E	3	01	42	900	22.1		No		3.739	3.750	26	24		
0	PSE-3.01.43	E	3	01	43	900	22.1		No		3.739	3.750	24	19		
0	PSE-3.01.44	E	3	01	44	900	22.1		No		3.739	3.750	24	19		
0	PSE-3.01.45	E	3	01	45	900	22.1		No		3.739	3.750	24	19		
0	PSE-3.02.01	E	3	02	01	900	22.1		No		3.739	3.750	24	19		
0	PSE-3.02.02	E	3	02	02	900	22.1		No		3.739	3.750	18	15		
0	PSE-3.02.03	E	3	02	03	900	22.1		No		3.739	3.750	18	15		
0	PSE-3.02.04	E	3	02	04	900	22.1		No		3.739	3.750	18	15		
0	PSE-3.02.05	E	3	02	05	900	22.1		No		3.739	3.750	18	15		

NEWPCC RAS PIPING SUPPORTS LIST

REV.	TAG # (note 3)*	EXISTING (E) NEW (N)	PIPING SYSTEM	TYPE	SUPPORT NO.	PIPE DIA. (mm)	Weight of pipe (filled w/ sludge) (kN) (note 1)*	Dist. CL Pipe to F/O Wall (mm) (note 2)*	Cable Tray Support	T/O Tray Support EL. (m) (note 2)*	PIPE CL ELEVATION		GRID		REFERENCE DWG #	COMMENTS
											MEASURED. (m) (note 2)*	DESIGN. (m)	US	DS		
0	PSE-3.02.06	E	3	02	06	900	22.1		No		3.739	3.750	18	15		
0	PSE-3.02.07	E	3	02	07	900	22.1		No		3.739	3.750	15	12		
0	PSE-3.02.08	E	3	02	08	900	22.1		No		3.739	3.750	15	12		
0	PSE-3.02.09	E	3	02	09	900	22.1		No		3.739	3.750	15	12		
0	PSE-3.02.10	E	3	02	10	900	22.1		No		3.739	3.750	12	9		
0	PSE-3.02.11	E	3	02	11	900	22.1		No		3.739	3.750	12	9		
0	PSE-3.02.12	E	3	02	12	900	22.1		No		3.739	3.750	12	9		
0	PSE-3.02.13	E	3	02	13	900	22.1		No		3.739	3.750	12	9		
0	PSE-3.02.14	E	3	02	14	900	22.1		No		3.739	3.750	12	9		
0	PSE-3.02.15	E	3	02	15	900	22.1		No		3.739	3.750	9	6		
0	PSE-3.02.16	E	3	02	16	900	22.1		No		3.739	3.750	9	6		
0	PSE-3.02.17	E	3	02	17	900	22.1		No		3.739	3.750	9	6		
0	PSE-3.02.18	E	3	02	18	900	22.1		No		3.739	3.750	9	6		
0	PSE-3.02.19	E	3	02	19	900	22.1		No		3.739	3.750	6	1A		
0	PSE-3.02.20	E	3	02	20	900	22.1		No		3.739	3.750	6	1A		
0	PSE-3.02.21	E	3	02	21	500	8.0		No		5.230	5.250	3B	4A		
0	PSE-3.02.22	E	3	02	22	500	8.0		No		5.230	5.250	3B	4A		
0	PSE-3.03.01	E	3	03	01	900	22.1		No		1.320	1.350	1A	2A		
0	PSE-3.03.02	E	3	03	02	900	22.1		No		3.094	3.100	2A	3A		
0	PSE-3.03.03	E	3	03	03	900	22.1		No		3.094	3.100	2A	3A		
0	PSE-3.03.04	E	3	03	04	900	22.1		No		3.094	3.100	2A	3A		
0	PSE-3.03.05	E	3	03	05	900	22.1		No		3.094	3.100	2A	3A		
0	PSE-3.03.06	E	3	03	06	900	22.1		No		3.094	3.100	2A	3A		
0	PSE-3.03.07	E	3	03	07	900	22.1		No		3.094	3.100	3B	4A		
0	PSE-3.03.08	E	3	03	08	900	22.1		No		3.094	3.100	3B	4A		
0	PSE-3.03.09	E	3	03	09	900	22.1		No		3.094	3.100	3B	4A		
0	PSE-3.03.10	E	3	03	10	900	22.1		No		3.094	3.100	3B	4A		
0	PSE-3.03.11	E	3	03	11	900	22.1		No		3.094	3.100	3B	4A		
0	PSE-3.03.12	E	3	03	12	900	22.1		No		3.094	3.100	3B	4A		
0	PSE-3.04.01	E	3	04	01	900	22.1		No		1.320	2.000	1A	2A		
0	PSE-3.04.02	E	3	04	02	900	22.1		No		5.230	5.250	3B	4A		
0	PSE-3.04.03	E	3	04	03	900	22.1		No		5.230	5.250	3B	4A		
0	PSE-3.04.04	E	3	04	04	600	10.9		No		5.230	5.250	3B	4A		
0	PSE-3.04.05	E	3	04	05	900	22.1		No		5.230	5.250	3B	4A		
0	PSE-3.04.06	E	3	04	06	600	10.9		No		5.230	5.250	3B	4A		
0	PSE-3.04.07	E	3	04	07	750	16.1		No		3.739	3.750	9	6		
0	PSE-4.04.01	E	4	04	01	250			No				9	6		To be re-used
0	PSE-4.04.02	E	4	04	02	250			No				40	37		To be re-used
0	PSE-4.04.03	E	4	04	03	250			No				12	9		To be re-used
0	PSE-4.04.04	E	4	04	04	250			No				12	9		Re-use hanger rod, repalce clevis to suit new pipe
0	PSE-4.04.06	E	4	04	06	250			No				33	29		To be re-used
0	PSE-4.04.07	E	4	04	07	250			No				34	33		To be re-used
0	PSE-4.04.08	E	4	04	08	250			No				37	34		To be re-used
0	PSE-4.04.09	E	4	04	09	300			No				37	34		To be re-used
0	PSE-4.04.10	E	4	04	10	300			No				37	34		To be re-used
0	PSE-4.04.11	E	4	04	11	300			No				40	37		To be re-used
0	PSE-4.04.12	E	4	04	12	300			No				40	37		To be re-used
0	PSE-4.04.13	E	4	04	13	300			No				40	37		To be re-used
0	PSE-4.04.14	E	4	04	14	300			No				37	34		To be re-used
0	PSE-4.04.15	E	4	04	15	300			No				37	34		To be re-used
0	PSE-4.04.16	E	4	04	16	300			No				40	37		To be re-used
0	PSE-4.04.17	E	4	04	17	300			No				40	37		To be re-used
0	PSE-4.DEMO.05	E	4	DEMO	05	250			No				15	12		Demo
0	PSE-4.DEMO.18	E	4	DEMO	18	300			No				37	34		Demo

NEWPCC RAS PIPING SUPPORTS LIST

REV.	TAG # (note 3)*	EXISTING (E) NEW (N)	PIPING SYSTEM	TYPE	SUPPORT NO.	PIPE DIA. (mm)	Weight of pipe (filled w/ sludge) (kN) (note 1)*	Dist. CL Pipe to F/O Wall (mm) (note 2)*	Cable Tray Support	T/O Tray Support EL. (m) (note 2)*	PIPE CL ELEVATION		GRID		REFERENCE DWG #	COMMENTS
											MEASURED. (m) (note 2)*	DESIGN. (m)	US	DS		
0	PSE-4.DEMO.19	E	4	DEMO	19	300			No				37	34		Demo
0	PSE-4.DEMO.20	E	4	DEMO	20	300			No				40	37		Demo
0	PSE-4.DEMO.21	E	4	DEMO	21	300			No				40	37		Demo
0	PSE-4.DEMO.22	E	4	DEMO	22	300			No				37	34		Demo
0	PSN-1.01.01	N	1	01	01	450	6.7		No		3.758		54	50	1-0101S-S0020-001 - Type 1	To be braced to wall - refer to S02
0	PSN-1.01.02	N	1	01	02	450	6.7		No		2.372		54	50	1-0101S-S0020-001 - Type 1	
0	PSN-1.01.03	N	1	01	03	450	6.7		No		4.788		50	47	1-0101S-S0020-001 - Type 1	To be braced to wall - refer to S02
0	PSN-1.01.04	N	1	01	04	600	10.9		No		2.156		33	29	1-0101S-S0020-001 - Type 1	
0	PSN-1.01.05	N	1	01	05	600	10.9		No		2.156		29	26	1-0101S-S0020-001 - Type 1	
0	PSN-1.01.06	N	1	01	06	600	10.9		No		2.156		29	26	1-0101S-S0020-001 - Type 1	
0	PSN-1.01.07	N	1	01	07	600	10.9		No		2.156		29	26	1-0101S-S0020-001 - Type 1	
0	PSN-1.01.08	N	1	01	08	600	10.9		No		5.224		26	24	1-0101S-S0020-001 - Type 1	To be braced to wall - refer to S02
0	PSN-1.02.01	N	1	02	01	450	6.7	713.7	No				54	50	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.02	N	1	02	02	500	8.0	774.4	No				50	47	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.03	N	1	02	03	500	8.0	783.5	No				50	47	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.04	N	1	02	04	500	8.0	792.9	No				50	47	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.05	N	1	02	05	500	8.0	799.3	No				46	43	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.06	N	1	02	06	500	8.0	806.0	No				46	43	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.07	N	1	02	07	600	10.9	784.6	No				46	43	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.08	N	1	02	08	600	10.9	781.6	No				46	43	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.09	N	1	02	09	600	10.9	782.6	No				43	40	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.10	N	1	02	10	600	10.9	783.6	No				43	40	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.11	N	1	02	11	600	10.9	784.5	No				43	40	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.12	N	1	02	12	600	10.9	785.5	No				43	40	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.13	N	1	02	13	600	10.9	786.5	No				40	37	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.14	N	1	02	14	600	10.9	787.5	No				40	37	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.15	N	1	02	15	600	10.9	788.4	No				40	37	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.16	N	1	02	16	600	10.9	789.4	No				40	37	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-1.02.17	N	1	02	17	600	10.9	790.3	No				37	34	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-1.02.18	N	1	02	18	600	10.9	791.3	No				37	34	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-1.02.19	N	1	02	19	600	10.9	792.3	No				37	34	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.20	N	1	02	20	600	10.9	793.0	No				37	34	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-1.02.21	N	1	02	21	600	10.9	794.1	No				33	29	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.22	N	1	02	22	600	10.9	794.9	No				33	29	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-1.02.23	N	1	02	23	600	10.9	788.6	No				26	24	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.24	N	1	02	24	600	10.9	790.7	No				26	24	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-1.02.25	N	1	02	25	600	10.9	795.9	No				26	24	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-1.02.26	N	1	02	26	600	10.9	801.1	No				24	19	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-1.02.27	N	1	02	27	600	10.9	805.9	No				24	19	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-1.02.28	N	1	02	28	750	16.1	804.0	No				24	19	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.29	N	1	02	29	750	16.1	792.0	No				24	19	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.30	N	1	02	30	750	16.1	777.2	No				18	15	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.31	N	1	02	31	750	16.1	768.6	No				18	15	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.32	N	1	02	32	750	16.1	763.8	No				18	15	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.33	N	1	02	33	750	16.1	762.2	No				18	15	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.34	N	1	02	34	750	16.1	764.3	No				15	12	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.35	N	1	02	35	750	16.1	766.6	No				15	12	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.36	N	1	02	36	750	16.1	768.7	No				15	12	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.37	N	1	02	37	750	16.1	770.8	No				15	12	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.38	N	1	02	38	750	16.1	772.7	No				12	9	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.39	N	1	02	39	750	16.1	774.7	No				12	9	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.40	N	1	02	40	900	22.1	776.7	No				12	9	1-0101S-S0020-001 - Type 2	

NEWPCC RAS PIPING SUPPORTS LIST

REV.	TAG # (note 3)*	EXISTING (E) NEW (N)	PIPING SYSTEM	TYPE	SUPPORT NO.	PIPE DIA. (mm)	Weight of pipe (filled w/ sludge) (kN) (note 1)*	Dist. CL Pipe to F/O Wall (mm) (note 2)*	Cable Tray Support	T/O Tray Support EL. (m) (note 2)*	PIPE CL ELEVATION		GRID		REFERENCE DWG #	COMMENTS
											MEASURED. (m) (note 2)*	DESIGN. (m)	US	DS		
0	PSN-1.02.41	N	1	02	41	900	22.1	779.3	No				12	9	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.42	N	1	02	42	900	22.1	782.3	No				9	6	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.43	N	1	02	43	900	22.1	785.3	No				9	6	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.44	N	1	02	44	900	22.1	787.9	No				9	6	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.45	N	1	02	45	900	22.1	791.0	No				9	6	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.46	N	1	02	46	900	22.1	794.1	No				6	1A	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.47	N	1	02	47	900	22.1	797.0	No				6	1A	1-0101S-S0020-001 - Type 2	
0	PSN-1.02.48	N	1	02	48	900	22.1	799.8	No				6	1A	1-0101S-S0020-001 - Type 2	
0	PSN-1.03.01	N	1	03	01	900	22.1		No		0.619		1A	2A	1-0101S-S0020-002 - Type 1C	
0	PSN-1.03.02	N	1	03	02	900	22.1		No		0.616		1A	2A	1-0101S-S0020-002 - Type 1C	
0	PSN-1.03.03	N	1	03	03	900	22.1		No		0.612		1A	2A	1-0101S-S0020-002 - Type 1C	
0	PSN-1.03.04	N	1	03	04	900	22.1		No		0.606		1A	2A	1-0101S-S0020-002 - Type 1C	
0	PSN-1.04.01	N	1	04	01	900	22.1		No				1A	2A	1-0101S-M0016-001 - Hanger	
0	PSN-1.04.02	N	1	04	02	900	22.1		No				1A	2A	1-0101S-M0016-001 - Hanger	
0	PSN-1.04.03	N	1	04	03	600	10.9		No				29	26	1-0101S-M0023-001 - Elbow Base	
0	PSN-1.04.04	N	1	04	04	500	8.0		No				1A	2A	1-0101S-M0016-001 - Clamp	
0	PSN-1.04.05	N	1	04	05	500	8.0		No				1A	2A	1-0101S-M0016-001 - Clamp	
0	PSN-1.04.06	N	1	04	06	600	10.9		No				33	29	1-0101S-S0020-002 - Type 3	
0	PSN-2.01.01	N	2	01	01	300	4.0		No		2.639		29	26	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.02	N	2	01	02	300	4.0		No		2.642		29	26	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.03	N	2	01	03	450	6.7		No		3.951		26	24	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.04	N	2	01	04	450	6.7		No		3.955		26	24	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.05	N	2	01	05	450	6.7		No		3.959		26	24	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.06	N	2	01	06	600	10.9		No		3.956		24	19	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.07	N	2	01	07	600	10.9		No		3.952		24	19	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.08	N	2	01	08	600	10.9		No		3.966		24	19	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.09	N	2	01	09	600	10.9		Yes	2.157	3.969		24	19	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.10	N	2	01	10	750	16.1		Yes	2.157	3.946		24	19	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.11	N	2	01	11	750	16.1		Yes	2.157	3.933		18	15	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.12	N	2	01	12	750	16.1		Yes	2.157	3.921		18	15	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.13	N	2	01	13	750	16.1		Yes	2.157	3.907		18	15	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.14	N	2	01	14	750	16.1		Yes	2.157	3.896		18	15	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.15	N	2	01	15	750	16.1		Yes	2.157	3.885		15	12	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.16	N	2	01	16	750	16.1		Yes	2.157	3.873		15	12	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.17	N	2	01	17	750	16.1		Yes	2.157	3.86		15	12	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.18	N	2	01	18	750	16.1		Yes	2.157	3.845		15	12	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.19	N	2	01	19	750	16.1		Yes	2.157	3.839		15	12	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.20	N	2	01	20	900	22.1		Yes	2.157	3.792		12	9	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.21	N	2	01	21	900	22.1		Yes	2.157	3.78		12	9	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.22	N	2	01	22	900	22.1		Yes	2.157	3.771		12	9	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.23	N	2	01	23	900	22.1		Yes	2.157	3.76		12	9	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.24	N	2	01	24	900	22.1		Yes	2.157	3.749		12	9	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.25	N	2	01	25	900	22.1		Yes	2.157	3.738		9	6	1-0101S-S0020-001 - Type 1	
0	PSN-2.01.26	N	2	01	26	900	22.1		No		3.73		9	6	1-0101S-S0020-001 - Type 1	
0	PSN-2.04.01	N	2	04	01	300	4.0		No				29	26	1-0101S-M0023-001 - Elbow Base	
0	PSN-2.05.01	N	2	05	01	900	22.1		No		1.336		9	6	1-0101S-S0020-002 - Type 1B	
0	PSN-2.05.02	N	2	05	02	900	22.1		No		1.346		9	6	1-0101S-S0020-002 - Type 1B	
0	PSN-2.05.03	N	2	05	03	900	22.1		No		1.356		6	1A	1-0101S-S0020-002 - Type 1B	
0	PSN-2.05.04	N	2	05	04	900	22.1		No		1.366		6	1A	1-0101S-S0020-002 - Type 1B	
0	PSN-2.05.05	N	2	05	05	900	22.1		No		1.374		1A	2A	1-0101S-S0020-002 - Type 1B	
0	PSN-2.05.06	N	2	05	06	900	22.1		No		1.376		1A	2A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.01.01	N	3	01	01	300	4.0		Yes	2.720	3.775		57	54	1-0101S-S0020-001 - Type 1	
0	PSN-3.01.02	N	3	01	02	300	4.0		Yes	2.720	3.777		57	54	1-0101S-S0020-001 - Type 1	

NEWPCC RAS PIPING SUPPORTS LIST

REV.	TAG # (note 3)*	EXISTING (E) NEW (N)	PIPING SYSTEM	TYPE	SUPPORT NO.	PIPE DIA. (mm)	Weight of pipe (filled w/ sludge) (kN) (note 1)*	Dist. CL Pipe to F/O Wall (mm) (note 2)*	Cable Tray Support	T/O Tray Support EL. (m) (note 2)*	PIPE CL ELEVATION		GRID		REFERENCE DWG #	COMMENTS
											MEASURED. (m) (note 2)*	DESIGN. (m)	US	DS		
0	PSN-3.01.03	N	3	01	03	300	4.0		Yes	2.720	3.778	57	54	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.04	N	3	01	04	450	6.7		Yes	2.720	3.782	57	54	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.05	N	3	01	05	450	6.7		Yes	2.720	3.793	54	50	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.06	N	3	01	06	450	6.7		Yes	2.720	3.799	54	50	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.07	N	3	01	07	600	10.9		Yes	2.720	2.398	54	50	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.08	N	3	01	08	600	10.9		Yes	2.720	3.772	50	47	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.09	N	3	01	09	600	10.9		Yes	2.720	3.771	50	47	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.10	N	3	01	10	600	10.9		Yes	2.720	3.771	50	47	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.11	N	3	01	11	600	10.9		Yes	2.720	3.771	50	47	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.12	N	3	01	12	750	16.1		Yes	2.720	3.77	46	43	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.13	N	3	01	13	750	16.1		Yes	2.720	3.77	46	43	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.14	N	3	01	14	750	16.1		Yes	2.720	3.769	46	43	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.15	N	3	01	15	750	16.1		Yes	2.720	3.769	46	43	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.16	N	3	01	16	750	16.1		Yes	2.720	3.768	43	40	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.17	N	3	01	17	750	16.1		Yes	2.720	3.768	43	40	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.18	N	3	01	18	750	16.1		Yes	2.720	3.767	43	40	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.19	N	3	01	19	750	16.1		Yes	2.720	3.767	43	40	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.20	N	3	01	20	750	16.1		Yes	2.720	3.767	43	40	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.21	N	3	01	21	750	16.1		Yes	2.720	3.766	40	37	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.22	N	3	01	22	750	16.1		Yes	3.082	3.766	40	37	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.23	N	3	01	23	750	16.1		Yes	3.082	3.765	40	37	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.24	N	3	01	24	900	22.1		Yes	3.082	3.765	40	37	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.25	N	3	01	25	900	22.1		Yes	3.082	3.764	37	34	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.26	N	3	01	26	900	22.1		Yes	3.082	3.763	37	34	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.27	N	3	01	27	900	22.1		Yes	3.082	3.762	37	34	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.28	N	3	01	28	900	22.1		Yes	2.645	3.761	37	34	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.29	N	3	01	29	900	22.1		Yes	2.645	3.76	33	29	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.30	N	3	01	30	900	22.1		Yes	2.645	3.759	33	29	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.31	N	3	01	31	900	22.1		Yes	2.645	3.758	33	29	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.32	N	3	01	32	900	22.1		Yes	2.645	3.758	33	29	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.33	N	3	01	33	900	22.1		Yes	2.645	3.757	29	26	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.34	N	3	01	34	900	22.1		No		1.974	29	26	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.35	N	3	01	35	900	22.1		Yes	2.645	3.755	26	24	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.36	N	3	01	36	900	22.1		Yes	2.645	3.754	26	24	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.37	N	3	01	37	900	22.1		Yes	2.645	3.753	26	24	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.38	N	3	01	38	900	22.1		Yes	2.645	3.752	26	24	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.39	N	3	01	39	900	22.1		Yes	2.645	3.752	26	24	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.40	N	3	01	40	900	22.1		Yes	2.645	3.751	24	19	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.41	N	3	01	41	900	22.1		Yes	2.645	3.75	24	19	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.42	N	3	01	42	900	22.1		No		3.75	24	19	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.43	N	3	01	43	900	22.1		No		3.73	24	19	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.44	N	3	01	44	900	22.1		No		3.715	24	19	1-0101S-S0020-001 - Type 1		
0	PSN-3.01.45	N	3	01	45	900	22.1		No		2.6	3A	4A	1-0101S-S0020-001 - Type 1		
0	PSN-3.02.01	N	3	02	01	900	22.1	921.2	No			24	19	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.02	N	3	02	02	900	22.1	920.1	No			18	15	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.03	N	3	02	03	900	22.1	918.9	No			18	15	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.04	N	3	02	04	900	22.1	917.8	No			18	15	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.05	N	3	02	05	900	22.1	916.6	No			18	15	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.06	N	3	02	06	900	22.1	915.3	No			15	12	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.07	N	3	02	07	900	22.1	914.2	No			15	12	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.08	N	3	02	08	900	22.1	913.0	No			15	12	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.09	N	3	02	09	900	22.1	911.9	No			15	12	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.10	N	3	02	10	900	22.1	910.6	No			12	9	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.11	N	3	02	11	900	22.1	909.5	No			12	9	1-0101S-S0020-001 - Type 2		
0	PSN-3.02.12	N	3	02	12	900	22.1	908.4	No			12	9	1-0101S-S0020-001 - Type 2		

NEWPCC RAS PIPING SUPPORTS LIST

REV.	TAG # (note 3)*	EXISTING (E) NEW (N)	PIPING SYSTEM	TYPE	SUPPORT NO.	PIPE DIA. (mm)	Weight of pipe (filled w/ sludge) (kN) (note 1)*	Dist. CL Pipe to F/O Wall (mm) (note 2)*	Cable Tray Support	T/O Tray Support EL. (m) (note 2)*	PIPE CL ELEVATION		GRID		REFERENCE DWG #	COMMENTS
											MEASURED. (m) (note 2)*	DESIGN. (m)	US	DS		
0	PSN-3.02.13	N	3	02	13	900	22.1	907.2	No				12	9	1-0101S-S0020-001 - Type 2	
0	PSN-3.02.14	N	3	02	14	900	22.1	906.1	No				9	6	1-0101S-S0020-001 - Type 2	
0	PSN-3.02.15	N	3	02	15	900	22.1	905.3	No				9	6	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-3.02.16	N	3	02	16	900	22.1	904.3	No				9	6	1-0101S-S0020-001 - Type 2	Provide attachment plate
0	PSN-3.02.17	N	3	02	17	900	22.1	903.2	No				9	6	1-0101S-S0020-001 - Type 2	
0	PSN-3.02.18	N	3	02	18	900	22.1	902.1	No				6	1A	1-0101S-S0020-001 - Type 2	
0	PSN-3.02.19	N	3	02	19	900	22.1	900.8	No				6	1A	1-0101S-S0020-001 - Type 2	
0	PSN-3.02.20	N	3	02	20	900	22.1	900.0	No				1A	2A	1-0101S-S0020-001 - Type 2	
0	PSN-3.04.01	N	3	04	01	600	10.9		No				54	50	1-0101S-M0023-001 - Elbow Base	
0	PSN-3.04.02	N	3	04	02	600	10.9		No				50	47	1-0101S-M0023-001 - Elbow Base	
0	PSN-3.04.03	N	3	04	03	900	22.1		No				29	26	1-0101S-M0023-001 - Elbow Base	
0	PSN-3.04.04	N	3	04	04	900	22.1		No				29	26	1-0101S-M0023-001 - Elbow Base	
0	PSN-3.04.05	N	3	04	05	500	8.0		No				3A	4A	1-0101S-M0016-001 - Clamp	
0	PSN-3.04.06	N	3	04	06	500	8.0		No				3A	4A	1-0101S-M0016-001 - Clamp	
0	PSN-3.05.01	N	3	05	01	900	22.1		No		0.929		2A	3A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.02	N	3	05	02	900	22.1		No		0.929		2A	3A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.03	N	3	05	03	900	22.1		No		0.929		2A	3A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.04	N	3	05	04	900	22.1		No		0.929		2A	3A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.05	N	3	05	05	900	22.1		No		0.929		2A	3A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.06	N	3	05	06	900	22.1		No		0.929		3B	4A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.07	N	3	05	07	900	22.1		No		0.929		3B	4A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.08	N	3	05	08	900	22.1		No		0.929		3B	4A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.09	N	3	05	09	900	22.1		No		0.929		3B	4A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.10	N	3	05	10	900	22.1		No		0.929		3B	4A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.11	N	3	05	11	900	22.1		No		0.929		3B	4A	1-0101S-S0020-002 - Type 1B	
0	PSN-3.05.12	N	3	05	12	900	22.1		No		0.929		3B	4A	1-0101S-S0020-002 - Type 1B	
0	PSN-4.01.01	N	4	01	01	300	3.5		No		2.63		37	34	1-0101S-S0020-001 - Type 1	
0	PSN-4.02.01	N	4	02	01	250	2.6	705	No				24	19	1-0101S-M0024-002 - Type 2A	
0	PSN-4.02.02	N	4	02	02	250	2.6	705	No				24	19	1-0101S-M0024-002 - Type 2A	
0	PSN-4.02.03	N	4	02	03	250	2.6	705	No				26	24	1-0101S-M0024-002 - Type 2A	
0	PSN-4.02.04	N	4	02	04	250	2.6	705	No				29	26	1-0101S-M0024-002 - Type 2B	
0	PSN-4.02.05	N	4	02	05	250	2.6	705	No				29	26	1-0101S-M0024-002 - Type 2B	
0	PSN-4.02.06	N	4	02	06	250	2.6	705	No				33	29	1-0101S-M0024-002 - Type 2B	
0	PSN-4.02.07	N	4	02	07	250	2.6	705	No				33	29	1-0101S-M0024-002 - Type 2B	
0	PSN-4.02.08	N	4	02	08	250	2.6	705	No				37	34	1-0101S-M0024-002 - Type 2A	
0	PSN-4.02.09	N	4	02	09	250	2.6	705	No				37	34	1-0101S-M0024-002 - Type 2A	
0	PSN-4.02.10	N	4	02	10	250	2.6	280	No				15	12	1-0101S-M0024-002 - Type 2D	Requires vertical angle
0	PSN-4.02.11	N	4	02	11	250	2.6	280	No				15	12	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.12	N	4	02	12	250	2.6	280	No				18	15	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.13	N	4	02	13	250	2.6	280	No				24	19	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.14	N	4	02	14	250	2.6	280	No				24	19	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.15	N	4	02	15	250	2.6	280	No				24	19	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.16	N	4	02	16	250	2.6	280	No				26	24	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.17	N	4	02	17	250	2.6	280	No				29	26	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.18	N	4	02	18	250	2.6	280	No				29	26	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.19	N	4	02	19	250	2.6	280	No				33	29	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.20	N	4	02	20	250	2.6	280	No				37	34	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.21	N	4	02	21	250	2.6	280	No				37	34	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.22	N	4	02	22	250	2.6	280	No				40	37	1-0101S-M0024-002 - Type 2D	
0	PSN-4.02.23	N	4	02	23	300	3.5	315	No				40	37	1-0101S-M0024-002 - Type 2C	
0	PSN-4.02.24	N	4	02	24	300	3.5	315	No				37	34	1-0101S-M0024-002 - Type 2C	

NEWPCC RAS PIPING SUPPORTS LIST

REV.	TAG # (note 3)*	EXISTING (E) NEW (N)	PIPING SYSTEM	TYPE	SUPPORT NO.	PIPE DIA. (mm)	Weight of pipe (filled w/ sludge) (kN) (note 1)*	Dist. CL Pipe to F/O Wall (mm) (note 2)*	Cable Tray Support	T/O Tray Support EL. (m) (note 2)*	PIPE CL ELEVATION		GRID		REFERENCE DWG #	COMMENTS
											MEASURED. (m) (note 2)*	DESIGN. (m)	US	DS		
0	PSN-4.04.01	N	4	04	01	250	2.6	705	No				9	6	1-0101S-M0024-001 - Clevis A	
0	PSN-4.04.02	N	4	04	02	250	2.6	705	No				9	6	1-0101S-M0024-003 - Angle Member Type 2	
0	PSN-4.04.03	N	4	04	03	250	2.6	705	No				12	9	1-0101S-M0024-001 - Clevis A	
0	PSN-4.04.04	N	4	04	04	250	2.6	705	No				12	9	1-0101S-M0024-001 - Clevis A	
0	PSN-4.04.05	N	4	04	05	250	2.6	705	No				12	9	1-0101S-M0024-001 - Clevis A	
0	PSN-4.04.06	N	4	04	06	250	2.6	705	No				15	12	1-0101S-M0024-001 - Clevis A	
0	PSN-4.04.07	N	4	04	07	250	2.6	705	No				15	12	1-0101S-M0024-001 - Clevis A	
0	PSN-4.04.08	N	4	04	08	250	2.6	705	No				18	15	1-0101S-M0024-001 - Clevis A	
0	PSN-4.04.09	N	4	04	09	250	2.6	705	No				18	15	1-0101S-M0024-001 - Clevis A	
0	PSN-4.04.10	N	4	04	10	250	2.6	705	No				18	15	1-0101S-M0024-001 - Clevis A	
0	PSN-4.04.11	N	4	04	11	250	2.6	705	No				24	19	1-0101S-M0024-001 - Clevis C	
0	PSN-4.04.12	N	4	04	12	250	2.6	705	No				24	19	1-0101S-M0024-001 - Clevis C	
0	PSN-4.04.13	N	4	04	13	250	2.6	705	No				24	26	1-0101S-M0024-001 - Clevis C	
0	PSN-4.04.14	N	4	04	14	250	2.6	705	No				24	26	1-0101S-M0024-001 - Clevis C	
0	PSN-4.04.15	N	4	04	15	250	2.6	705	No				33	29	1-0101S-M0024-001 - Clevis C	
0	PSN-4.04.16	N	4	04	16	250	2.6	705	No				37	34	1-0101S-M0024-001 - Clevis C	
0	PSN-4.04.17	N	4	04	17	250	2.6	705	No				37	34	1-0101S-M0024-001 - Clevis C	
0	PSN-4.04.18	N	4	04	18	250	2.6	705	No				37	34	1-0101S-M0024-003 - Angle Member Type 2	
0	PSN-4.04.19	N	4	04	19	250	2.6		No				40	37	1-0101S-M0024-003 - Angle Member Type 1	
0	PSN-4.04.20	N	4	04	20	250	2.6	280	No						1-0101S-M0024-001 - Clevis B	
0	PSN-4.04.21	N	4	04	21	250	2.6		No				29	26	1-0101S-M0024-003 - Trapeze	
0	PSN-4.04.22	N	4	04	22	250	2.6		No				29	26	1-0101S-M0024-003 - Trapeze	
0	PSN-4.04.23	N	4	04	23	250	2.6		No				40	37	1-0101S-M0024-001 - Clevis B	
0	PSN-4.04.24	N	4	04	24	250	2.6		No				40	37	1-0101S-M0024-003 - Angle Member Type 1	
0	PSN-4.04.25	N	4	04	25	150	1.9		No				37	34	1-0101S-M0024-001 - Clevis B	

Notes:

- Weight based on maximum pipe span of 2.4m  
Density of sludge assumed to be 1,000kg/m3
- Contractor to verify dimensions in-field
- Pipe supports in the 3D model are tagged according to this list,  
refer to 3D model.

## Proximity Items List

0	2021-09-16	ISSUED FOR TENDER	AJF	JS
Revision	Date	Issued For	By	Approved
<b>City of Winnipeg</b>				
North End Sewage Treatment Plant (NEWPCC) Return Activated Sludge (RAS) Piping Refurbishment				
<b>Document Number</b>	LST-M-003_Proximity Items	<b>Revision</b>	0	

**Project Name:** North End Sewage Treatment Plant (NEWPCC) Return Activated Sludge (RAS) Piping Refurbishment

**Project Number:** 21-0107-001

**Client:** City of Winnipeg

**Document No:** LST-M-003\_Proximity Items

**Date:** September 16, 2021

**Revision:** 0

NEWPCC RAS Pipe Proximity Items List							
REV.	TAG	ITEM NO.	RAS TRAIN	TYPE	DISTANCE FROM RAS PIPE (mm)	ACTION	COMMENTS
0	PR-1.001	001	1	PIPE	43		
0	PR-1.002	002	1	VALVE	80		
0	PR-1.003	003	1	PIPE SUPPORT	13		
0	PR-1.004	004	1	PIPE	62		
0	PR-1.005	005	1	PIPE SUPPORT	363		
0	PR-1.006	006	1	HPV	55		
0	PR-1.007	007	1	PIPE	111		
0	PR-1.008	008	1	CONCRETE BEAM	31		
0	PR-1.009	009	1	PIPE	26		
0	PR-1.010	010	1	CABLE TRAY	95		
0	PR-1.011	011	1	PIPE	86		
0	PR-1.012	012	1	PIPE	43		
0	PR-1.013	013	1	PIPE	69		
0	PR-1.014	014	1	CONDUIT	98		
0	PR-1.015	015	1	STEEL BEAM	22		
0	PR-1.016	016	1	CABLE TRAY	9		
0	PR-1.017	017	1	RAILING	138		
0	PR-1.018	018	1	PIPE	105		
0	PR-1.019	019	1	PIPE	117		
0	PR-1.020	020	1	PIPE	85		
0	PR-1.021	021	1	PIPE	95		
0	PR-1.022	022	1	PIPE	70		
0	PR-1.023	023	1	PIPE	9		
0	PR-1.024	024	1	CONDUIT	156		
0	PR-2.001	001	2	PIPE	45		
0	PR-2.002	002	2	PIPE	109		
0	PR-2.003	003	2	PIPE	55		
0	PR-2.004	004	2	PIPE	127		
0	PR-2.005	005	2	CONDUIT	21		
0	PR-2.006	006	2	PIPE	83		
0	PR-2.007	007	2	COLUMN	107		
0	PR-2.008	008	2	COLUMN	135		
0	PR-2.009	009	2	COLUMN	134		
0	PR-2.010	010	2	CONDUIT	35		
0	PR-2.011	011	2	COLUMN	27		
0	PR-2.012	012	2	COLUMN	121		
0	PR-2.013	013	2	PIPE	142		
0	PR-2.014	014	2	RAILING	222		
0	PR-2.015	015	2	STEEL BEAM	51		
0	PR-2.016	016	2	PIPE SUPPORT	121		
0	PR-2.017	017	2	PIPE	10		
0	PR-2.018	018	2	STEEL BEAM	53		

## NEWPCC RAS Pipe Proximity Items List

REV.	TAG	ITEM NO.	RAS TRAIN	TYPE	DISTANCE FROM RAS PIPE (mm)	ACTION	COMMENTS
0	PR-2.019	019	2	CABLE TRAY SUPPORT	Attached to RAS 2		
0	PR-2.020	020	2	MEZZANINE SUPPORT	111		
0	PR-2.021	021	2	MEZZANINE SUPPORT	115		
0	PR-2.022	022	2	MEZZANINE SUPPORT	118		
0	PR-2.023	023	2	PIPE	60		
0	PR-3.001	001	3	PIPE	100		
0	PR-3.002	002	3	PIPE	21		
0	PR-3.003	003	3	PIPE	104		
0	PR-3.004	004	3	PIPE	169		
0	PR-3.005	005	3	PIPE	8		
0	PR-3.006	006	3	COLUMN	90		
0	PR-3.007	007	3	PIPE	157		
0	PR-3.008	008	3	PIPE	46		
0	PR-3.009	009	3	PIPE	44		
0	PR-3.010	010	3	CONDUIT	88		
0	PR-3.011	011	3	STEEL BEAM	27		
0	PR-3.012	012	3	CABLE TRAY	100		
0	PR-3.013	013	3	CONDUIT	18		
0	PR-3.014	014	3	PIPE	87		
0	PR-3.015	015	3	PIPE	69		
0	PR-3.016	016	3	PIPE	148		
0	PR-3.017	017	3	PIPE	75		
0	PR-3.018	018	3	PIPE	128		
0	PR-3.019	019	3	CONDUIT	74		
0	PR-3.020	020	3	CABLE TRAY	46		
0	PR-3.021	021	3	CONDUIT	29		
0	PR-3.022	022	3	VALVE	144		
0	PR-3.023	023	3	PIPE	Attached to RAS 3		
0	PR-3.024	024	3	PIPE	31		
0	PR-3.025	025	3	MEZZANINE SUPPORT	62		
0	PR-3.026	026	3	MEZZANINE SUPPORT	172		

## Pipe Wrap Termination Sleeves List

0	2021-09-16	ISSUED FOR TENDER	AJF	JS
Revision	Date	Issued For	By	Approved
<b>City of Winnipeg</b>				
North End Sewage Treatment Plant (NEWPCC) Return Activated Sludge (RAS) Piping Refurbishment				
<b>Document Number</b>	LST-M-001_Pipe Wrap Ter	<b>Revision</b>	0	

**Project Name:** North End Sewage Treatment Plant (NEWPCC) Return Activated Sludge (RAS) Piping Refurbishment

**Project Number:** 21-0107-001

**Client:** City of Winnipeg

**Document No:** LST-M-004\_Pipe Wrap Termination Sleeves

**Date:** September 16, 2021

**Revision:** 0

Pipe Wrap Termination Sleeves - Refer to Drawing M3.4, M3.5, M3.6						
REV.	TAG	VALVE	RAS TRAIN	SLEEVE OD (mm)	LENGTH (mm)	COMMENTS
0	SLV-R810-KV-1A	R810-KV-1A	1	559	150	
0	SLV-R815-KV-1B	R815-KV-1B	1	559	150	
0	SLV-S801-HV-01	S801-HV-01	1	825.5	75	
0	SLV-S802-HV-01	S802-HV-01	1	825.5	150	
0	SLV-S910-HV4-10	S910-HV4-10	1	365	150	
0	SLV-S943-HV-1	S943-HV-1	1	365	100	
0	SLV-S909-HV4-9	S909-HV4-9	1	365	75	
0	SLV-S907-HV2-7	S907-HV2-7	1	365	100	
0	SLV-S908-HV4-8	S908-HV4-8	1	365	150	
0	SLV-S905-HV4-5	S905-HV4-5	1	365	150	
0	SLV-S906-HV4-6	S906-HV4-6	1	365	100	
0	SLV-S903-HV4-3	S903-HV4-3	1	365	100	
0	SLV-S904-HV4-4	S904-HV4-4	1	365	75	
0	SLV-S902-HV4-2	S902-HV4-2	1	365	100	
0	SLV-S901-HV4-1	S901-HV4-1	1	365	75	
0	SLV-R820-KV-2A	R820-KV-2A	2	559	150	
0	SLV-R825-KV-2B	R825-KV-2B	2	559	150	
0	SLV-S802-HV-02	S802-HV-02	2	825.5	150	
0	SLV-S803-HV-02	S803-HV-02	2	825.5	150	
0	SLV-S911-HV4-11	S911-HV4-11	2	365	100	
0	SLV-S913-HV4-13	S913-HV4-13	2	365	100	
0	SLV-S912-HV4-12	S912-HV4-12	2	365	150	
0	SLV-S914-HV4-14	S914-HV4-14	2	365	150	
0	SLV-S915-HV4-15	S915-HV4-15	2	365	N/A	Sleeve to be fabricated from 14" elbow. Trim to angle for inside arc length of 50 mm
0	SLV-S916-HV4-16	S916-HV4-16	2	365	75	
0	SLV-S917-HV4-17	S917-HV4-17	2	365	N/A	Sleeve to be fabricated from 14" elbow. Trim to angle for inside arc length of 50 mm
0	SLV-S918-HV4-18	S918-HV4-18	2	365	150	
0	SLV-S801-HV-02	S801-HV-02	3	825.5	150	
0	SLV-R830-KV-3A	R830-KV-3A	3	559	150	
0	SLV-R835-KV-3B	R835-KV-3B	3	559	150	
0	SLV-S803-HV-01	S803-HV-01	3	825.5	150	
0	SLV-S919-HV4-19	S919-HV4-19	3	365	N/A	Sleeve to be fabricated from 14" elbow. Trim to angle for inside arc length of 50 mm
0	SLV-S920-HV4-20	S920-HV4-20	3	365	150	
0	SLV-S921-HV4-21	S921-HV4-21	3	365	150	
0	SLV-S922-HV4-22	S922-HV4-22	3	365	100	
0	SLV-S923-HV4-23	S923-HV4-23	3	365	N/A	Sleeve to be fabricated from 14" elbow. Trim to angle for inside arc length of 50 mm
0	SLV-S924-HV4-24	S924-HV4-24	3	365	150	

## Pipe Wrap Termination Sleeves - Refer to Drawing M3.4, M3.5, M3.6

REV.	TAG	VALVE	RAS TRAIN	SLEEVE OD (mm)	LENGTH (mm)	COMMENTS
0	SLV-S925-HV4-25	S925-HV4-25	3	365	150	
0	SLV-S926-HV4-26	S926-HV4-26	3	365	150	
0	SLV-S941-HV-3	S941-HV-3	3	305	150	
0	SLV-S942-HV-2	S942-HV-2	2	305	150	
0	SLV-S911-HV1-11	S911-HV1-11	2	505	150	
0	SLV-S912-HV1-12	S912-HV1-12	2	505	150	
0	SLV-S913-HV1-13	S913-HV1-13	2	505	150	
0	SLV-S914-HV1-14	S914-HV1-14	2	505	150	
0	SLV-S915-HV1-15	S915-HV1-15	2	505	150	
0	SLV-S916-HV1-16	S916-HV1-16	2	505	150	
0	SLV-S917-HV1-17	S917-HV1-17	2	505	150	
0	SLV-S918-HV1-18	S918-HV1-18	2	505	150	
0	SLV-S919-HV1-19	S919-HV1-19	3	505	150	
0	SLV-S920-HV1-20	S920-HV1-20	3	505	150	
0	SLV-S921-HV1-21	S921-HV1-21	3	505	150	
0	SLV-S922-HV1-22	S922-HV1-22	3	505	150	
0	SLV-S923-HV1-23	S923-HV1-23	3	505	150	
0	SLV-S924-HV1-24	S924-HV1-24	3	505	150	
0	SLV-S925-HV1-25	S925-HV1-25	3	505	150	
0	SLV-S926-HV1-26	S926-HV1-26	3	505	150	
0	SLV-CLAR-11	CLAR-11	2	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-12	CLAR-12	2	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-13	CLAR-13	2	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-14	CLAR-14	2	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-15	CLAR-15	2	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-16	CLAR-16	2	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-17	CLAR-17	2	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-18	CLAR-18	2	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-19	CLAR-19	3	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-20	CLAR-20	3	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-21	CLAR-21	3	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-22	CLAR-22	3	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-23	CLAR-23	3	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-24	CLAR-24	3	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLAR-25	CLAR-25	3	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm

Pipe Wrap Termination Sleeves - Refer to Drawing M3.4, M3.5, M3.6

REV.	TAG	VALVE	RAS TRAIN	SLEEVE OD (mm)	LENGTH (mm)	COMMENTS
0	SLV-CLAR-26	CLAR-26	3	505	N/A	Sleeve to be fabricated from 20" elbow. Trim to angle for inside arc length of 75 mm
0	SLV-CLO-1	CLO-1	1	135	N/A	
0	SLV-CLO-2	CLO-2	2	135	N/A	
0	SLV-CLO-3	CLO-3	3	135	N/A	
0	SLV-WAS-1	WAS-1	4	365	75	
0	SLV-S951-HV4-1	S951-HV4-1	4	192	150	
0	SLV-S954-HV4-4	S954-HV4-4	4	192	150	

**APPENDIX M - LEAK LOCATION REFERENCE PHOTOS**

**Project Name:** North End Sewage Treatment Plant (NEWPCC) Return Activated Sludge (RAS) Piping Refurbishment  
**Project Number:** 21-0107-001  
**Client:** City of Winnipeg  
**Date:** July 23, 2021  
**Revision:** A

### RAS Header 1 Leak Locations

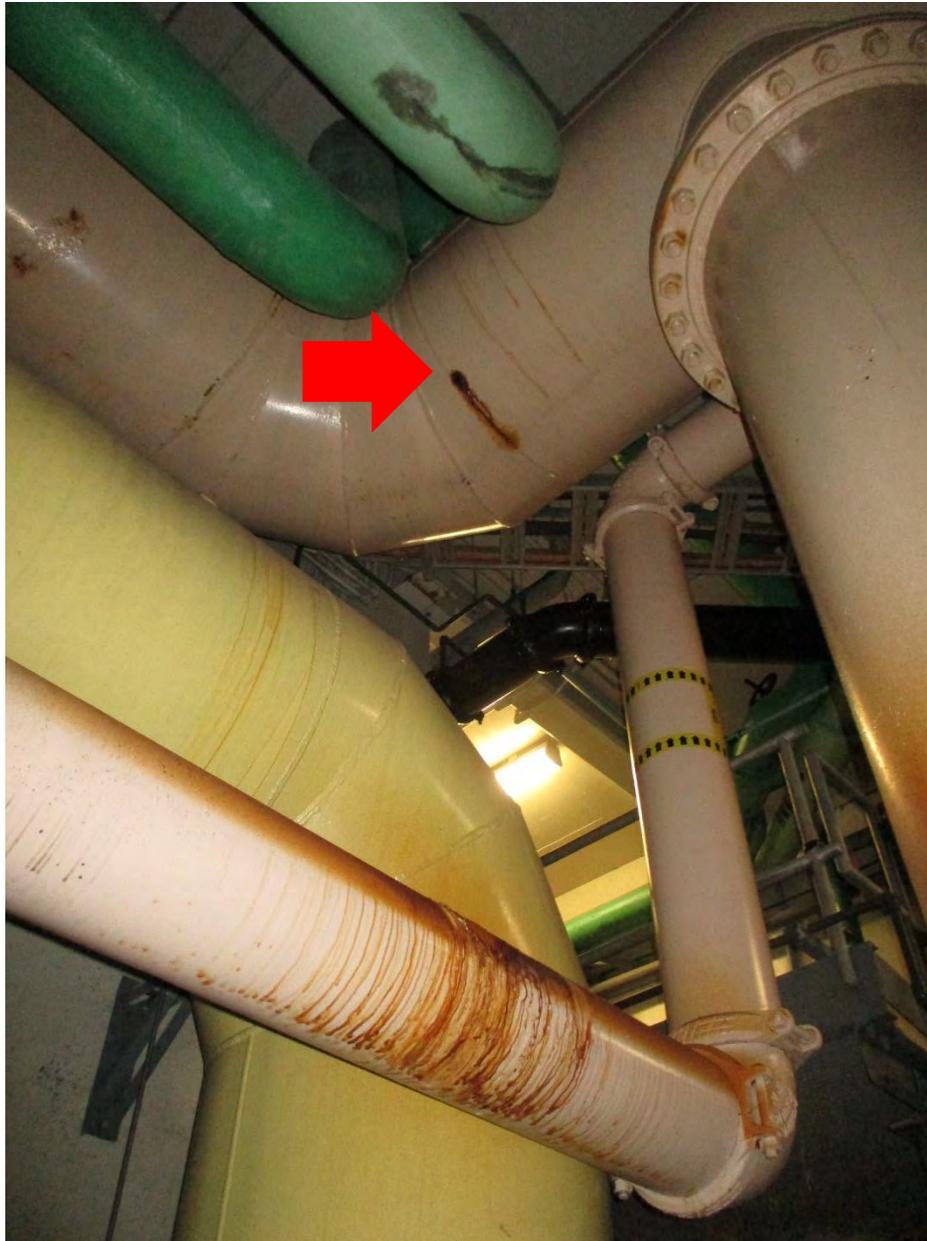


Figure 1: LK-1-001



Figure 2: LK-1-002

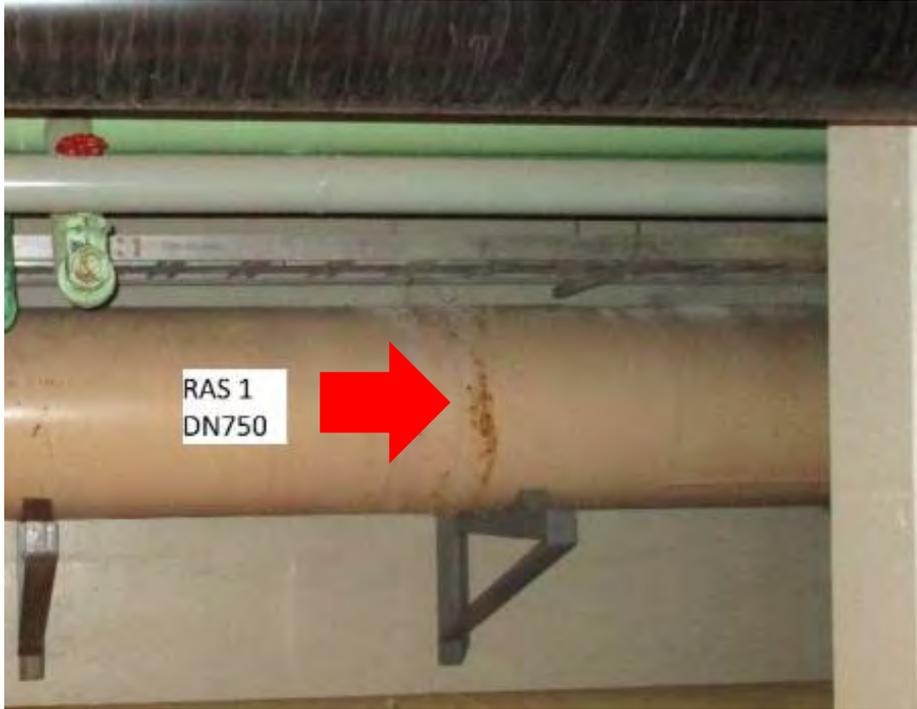


Figure 3: LK-1-003

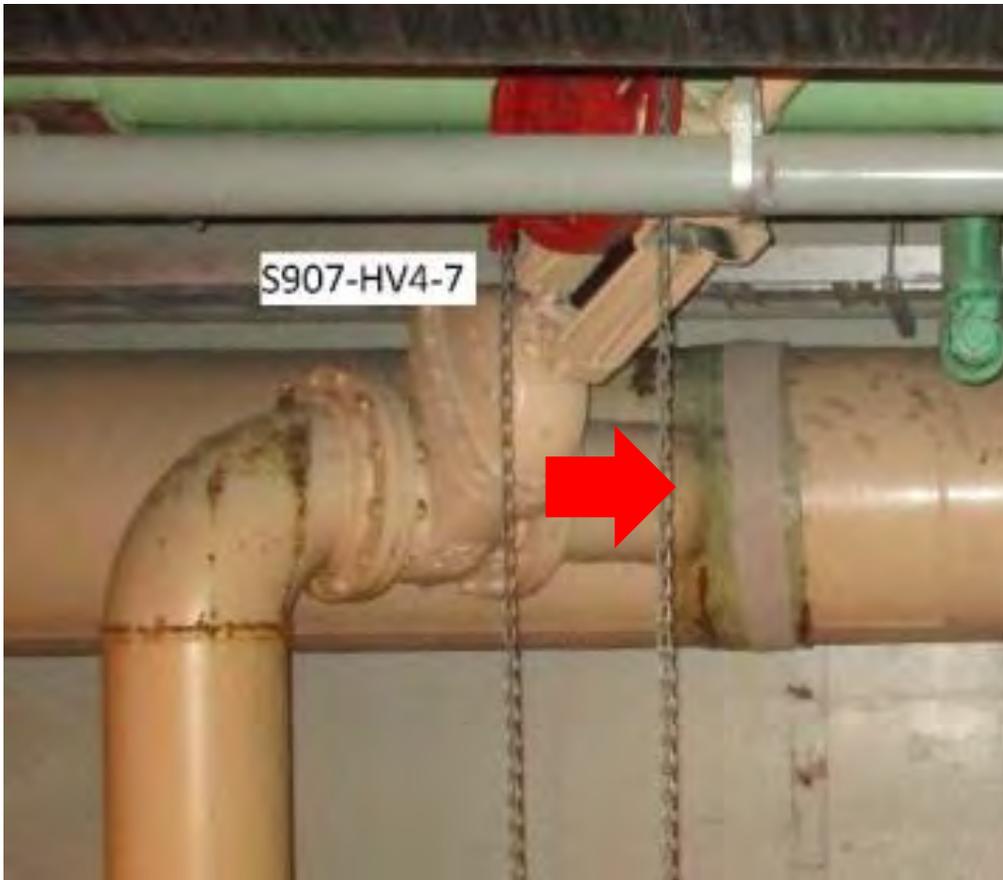


Figure 4: LK-1-004



Figure 5: LK-1-005



Figure 6: LK-1-006



Figure 7: LK-1-007



Figure 8: LK-1-008



Figure 9: LK-1-009

**RAS Header 2 Leak Locations**



Figure 10: LK-2-001



Figure 11: LK-2-002



Figure 12: LK-2-003



Figure 13: LK-2-004



Figure 14: LK-2-005

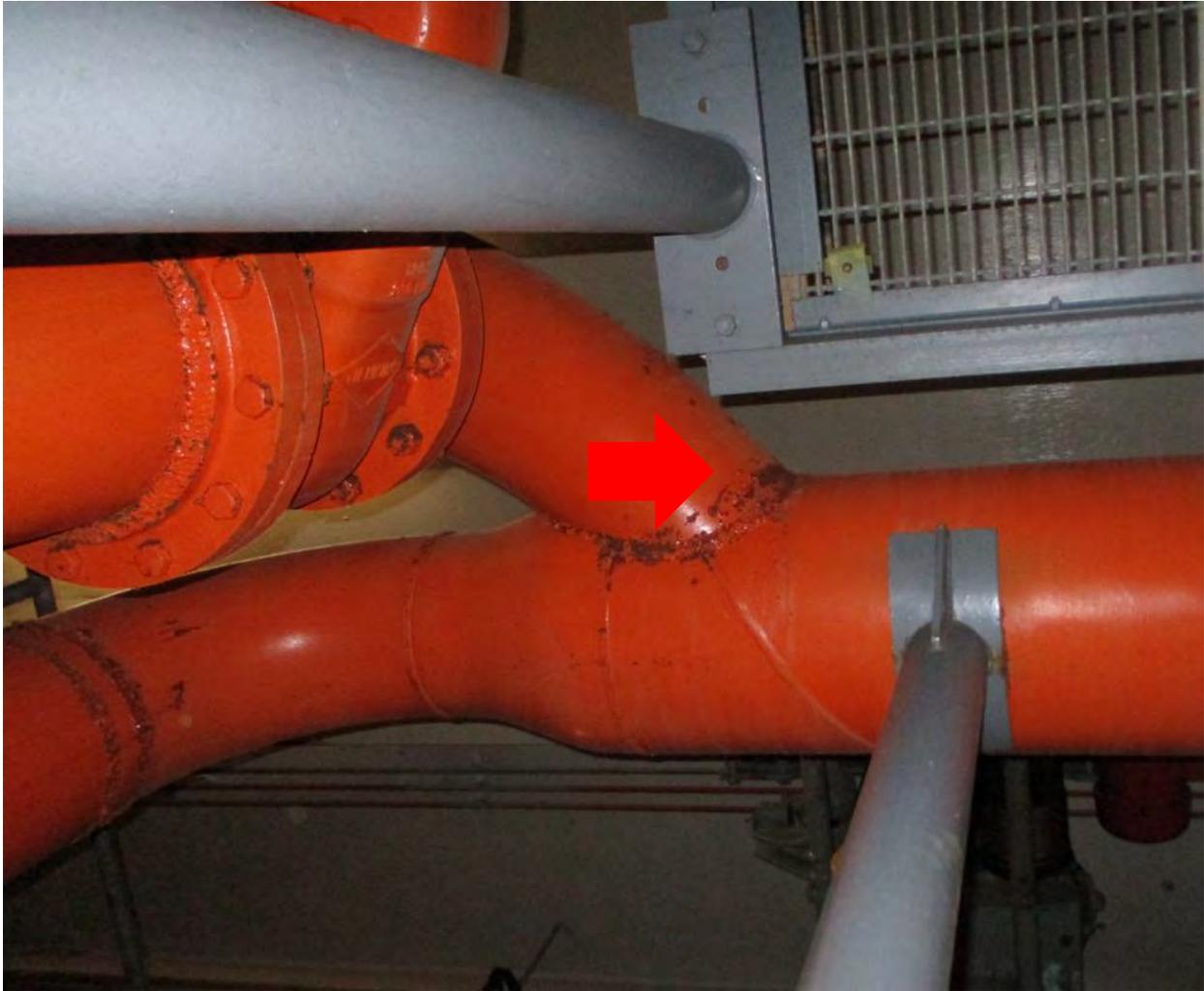


Figure 15: LK-2-006

**RAS Header 3 Leak Locations**



Figure 16: LK-3-001



Figure 17: LK-3-002



Figure 18: LK-3-003

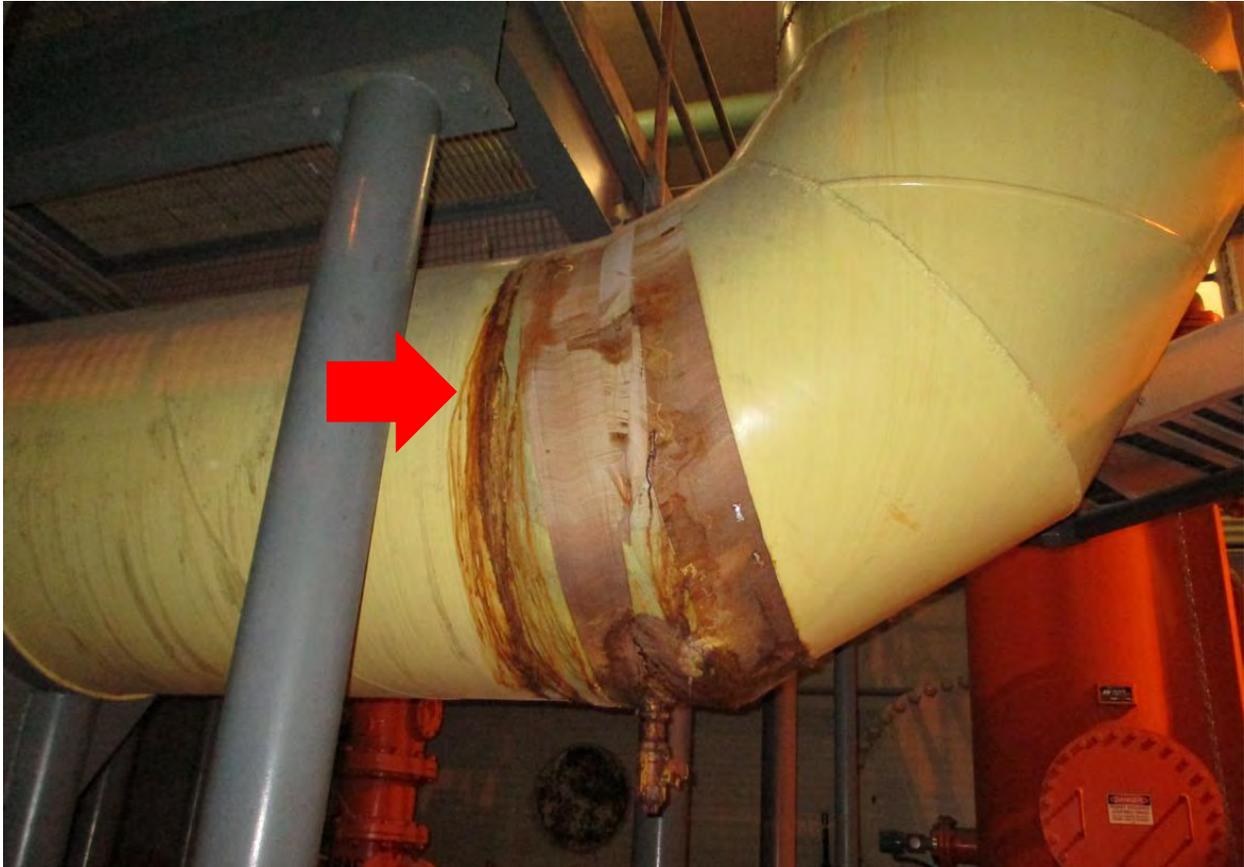


Figure 19: LK-3-004

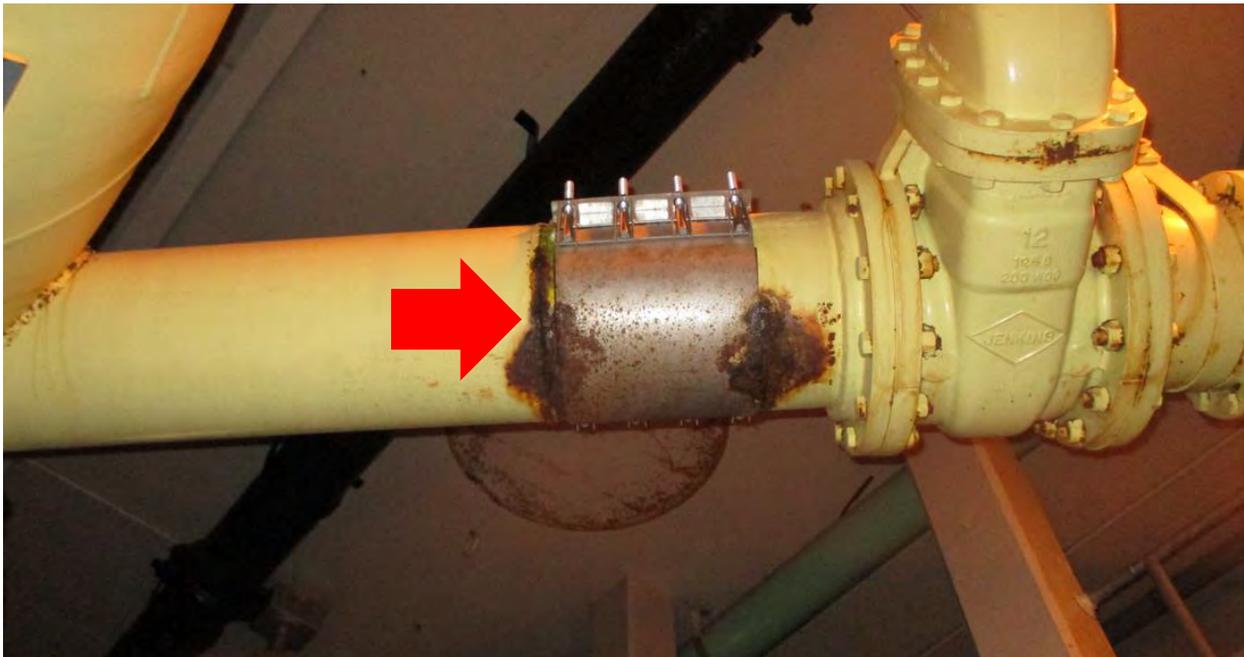


Figure 20: LK-3-005



Figure 21: LK-3-006

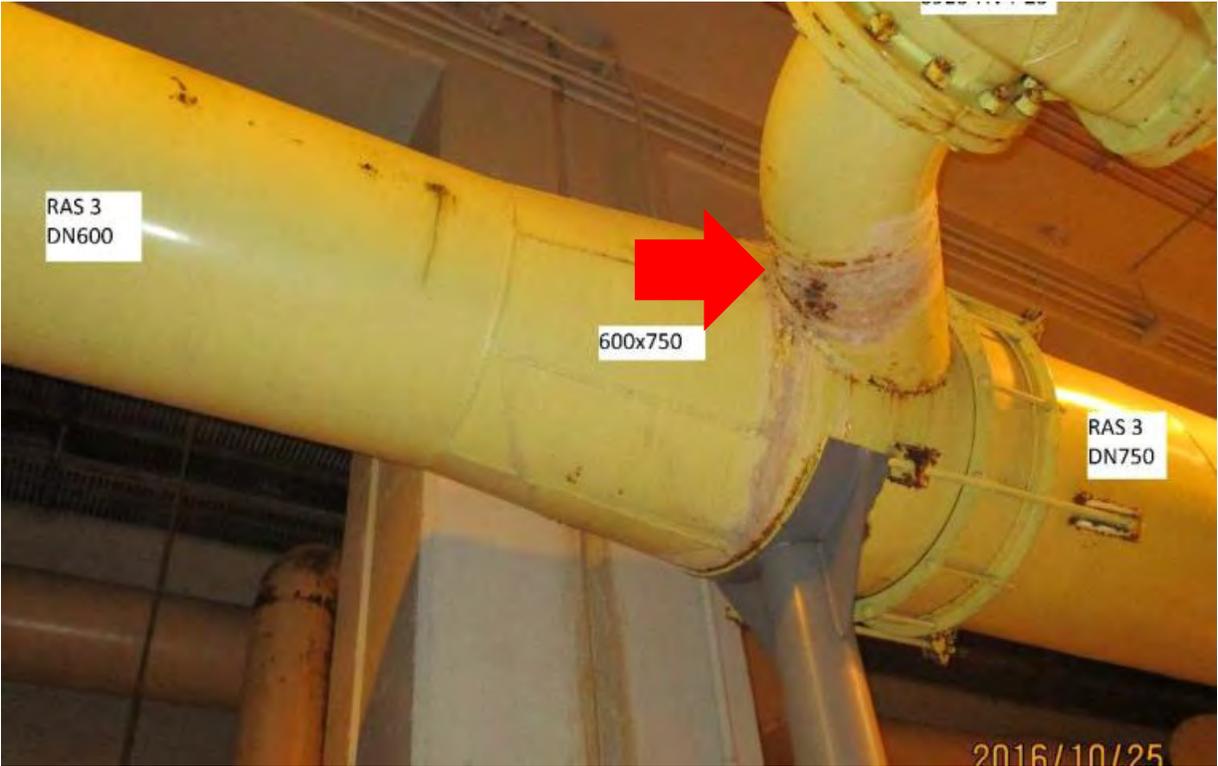


Figure 22: LK-3-007

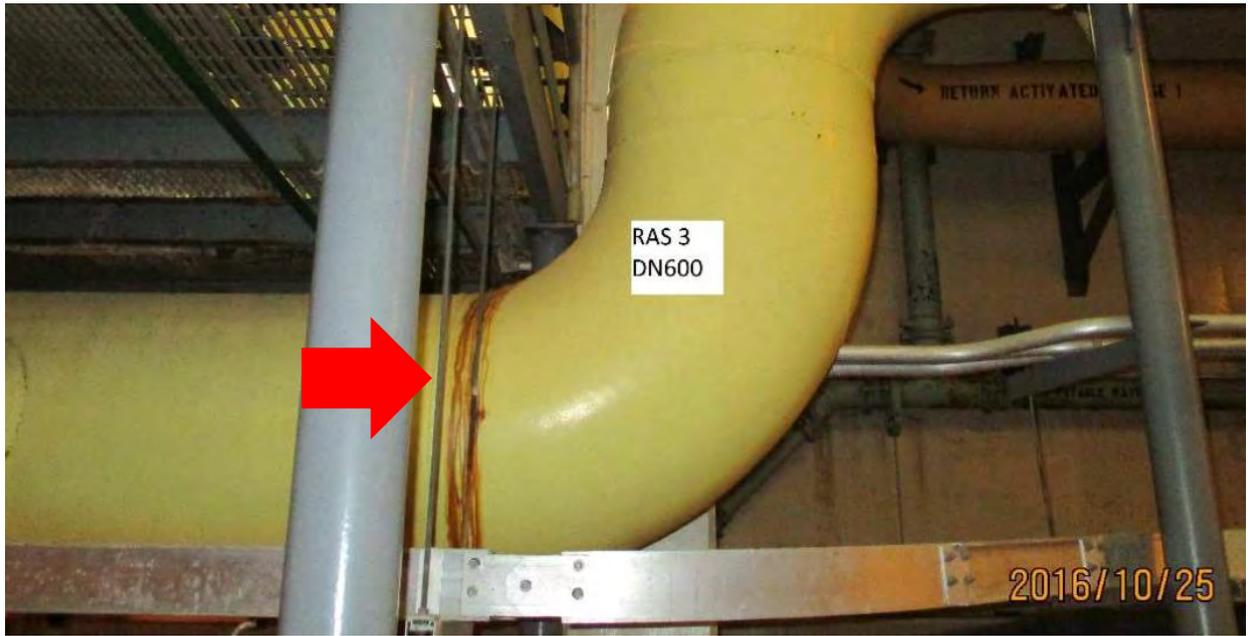


Figure 23: LK-3-008



Figure 24: LK-3-009



Figure 25: LK-3-010

**APPENDIX N – INSPECTION TEST PLAN**

**INSPECTION TEST PLAN - NORTH END SEWAGE TREATMENT PLANT (NEWPCC) RETURN ACTIVATED SLUDGE PIPING SYSTEM REFURBISHMENT**

<b>Project:</b>	CITY OF WINNIPEG BID OPPORTUNITY XXX-2021	
	NORTH END SEWAGE TREATMENT PLANT (NEWPCC) RETURN ACTIVATED SLUDGE PIPING SYSTEM REFURBISHMENT	
<b>System</b>	RAS Train #:	

	TASK	APPLICABLE QC DOCUMENTS/DWGS/STANDARDS	HOLD/WITNESS	SIGNOFF & DATE		
				CONTRACTOR	MANUFACTURER	CONTRACT ADMIN
1	Contractor accepts Manufacturer supplied materials. Materials have been inspected for defects and deficiencies.  Pre-install site visit inspection of RAS gallery performed by the Contractor and Manufacturer together to identify any locations where the design may vary from the pre-award documentation.	- CD-PM-TO-13: Form 100 – Certificate of Equipment Delivery  - CD-PM-TO-14: Form 101 – Certificate of Readiness to Install	N/A			
2	Successful completion of mock-up spool testing of composite repair wrap by pressure test of fabricated spool with proposed repair system and design thickness.	- Contractor supplied shop drawing of the fabrication details of the spool tested including the size and location of test defects.  - Completed test report including visual inspection results.  - Updated Installation Method Statement	HOLD			
3	Confirm completion of lead paint removal, inspection, and surface preparation of the substrate at all termination points.	- Completed surface preparation portion Quality Control Record Form in Appendix N for all sections of repair system.  - Confirm ultrasonic wall thickness testing has been completed where required at all terminations prior to surface preparation.	N/A			
4	Confirm completion of installation of repair system in accordance with design drawings and specifications.	- Fully completed installation Quality Control Record Form in Appendix N for Record for all sections of repair system applied.	HOLD			

**INSPECTION TEST PLAN - NORTH END SEWAGE TREATMENT PLANT (NEWPCC) RETURN ACTIVATED SLUDGE PIPING SYSTEM REFURBISHMENT**

<b>Project:</b>	CITY OF WINNIPEG BID OPPORTUNITY XXX-2021	
	NORTH END SEWAGE TREATMENT PLANT (NEWPCC) RETURN ACTIVATED SLUDGE PIPING SYSTEM REFURBISHMENT	
<b>System</b>	RAS Train #:	

TASK	APPLICABLE QC DOCUMENTS/DWGS/STANDARDS	HOLD/WITNESS	SIGNOFF & DATE		
			CONTRACTOR	MANUFACTURER	CONTRACT ADMIN
5 Confirm completion of inspection by FRP Designer of installed repair system for all three RAS trains.	- Visual inspection report, signed by FRP Designer to ASME PCC-2, Part 4, Article 4.1 Table 6.  - Provide QC destructive test results for installed repair laminate - RAS-1, RAS-2 and RAS-3, including: - Cure (hardness) - Repair system thickness	N/A			
6 Confirm installation of wrap repair system is complete and satisfactory as approved by inspection and testing from Manufacturer and Designer	- CD-PM-TO-15: Form 102 – Certificate of Satisfactory Installation	N/A			

INSPECTION TEST PLAN - NORTH END SEWAGE TREATMENT PLANT (NEWPCC) RETURN ACTIVATED SLUDGE PIPING SYSTEM REFURBISHMENT		
<b>Project:</b>	CITY OF WINNIPEG BID OPPORTUNITY XXX-2021	
	NORTH END SEWAGE TREATMENT PLANT (NEWPCC) RETURN ACTIVATED SLUDGE PIPING SYSTEM REFURBISHMENT	
<b>System</b>	RAS Train #:	

TASK	APPLICABLE QC DOCUMENTS/DWGS/STANDARDS	HOLD/WITNESS	SIGNOFF & DATE		
			CONTRACTOR	MANUFACTURER	CONTRACT ADMIN

I confirm that to the best of my knowledge the information contained in this document is accurate and reflects the current state of the equipment, parts, materials, etc. described herein.

CONTRACT ADMINISTRATOR		KGS GROUP			
	NAME	TITLE	CONTACT INFO	SIGNATURE	DATE
Representative:					

MANUFACTURER		T.B.D.			
	NAME	TITLE	CONTACT INFO	SIGNATURE	DATE
Representative:					

CONTRACTOR		T.B.D.			
	NAME	TITLE	CONTACT INFO	SIGNATURE	DATE
Representative:					

**APPENDIX O- QUALITY CONTROL RECORDS**

<b>COMPOSITE WRAP REPAIR SYSTEM QC CHECKLIST</b>	
CITY OF WINNIPEG BID OPPORTUNITY 538-2021	
NORTH END SEWAGE TREATMENT PLANT (NEWPCC) RETURN ACTIVATED SLUDGE PIPING SYSTEM REFURBISHMENT	
APPLICATOR:	
DATE:	
RAS TRAIN:	
REPAIR ID No.:	
REPAIR START LOC.	
REPAIR END LOC.	
REPAIR DIAMETER:	
REPAIR LENGTH:	
METHOD OF APPLICATION (REF. DOCUMENT):	

Time	Temp °C	Relative Humidity %	Substrate Temp °C	Dew Point °C	
					INITIAL:

SURFACE PREP METHOD:		INITIAL
SURFACE PREP SSPC/NACE No.:		INITIAL
SURFACE PREP PRODUCTS NAME/EXP/LOT #		INITIAL

RAW MATERIALS HAVE BEEN INSPECTED TO ENSURE PROPER LABELLING, EXPIRATION DATE, CONTAINER SEAL, STORAGE CONDITIONS, AND QUANTITIES		INITIAL
STORAGE CONDITIONS TEMP (°C), HUMIDITY (%)		INITIAL
FILLER PRODUCT NAME/EXP/LOT #		INITIAL
PRIMER ADHESIVE PRODUCT NAME/EXP/LOT #		INITIAL
WET-OUT PRODUCT NAME/EXP/LOT #		INITIAL

WRAP THICKNESS:		INITIAL
NO. OF WRAPS:		INITIAL
WRAP LAY-UP:		INITIAL

Primer Mixing	Segregate Primer containers from Wet-Out containers. Pour contents of one container of A side Primer into one container of B side Primer. Scrape out A side container ensuring any residual contents are combined with B side. Mix with stir stick or jiffy mixer until color is uniform throughout. 1-2 minutes.	INITIAL:
Primer Application	Apply Primer using spreader to the prepped surface ensuring complete coverage and no drips or runs.	INITIAL:
Wet-Out Mixing	Combine and mix Wet-Out using same procedure as was used for Primer. Thoroughly mix with stir stick or Jiffy mixer for 1-2 minutes.	INITIAL:
Fabric Saturation	Apply Wet-Out to fabric by laying out dry fabric on clean non porous surface (table covered in plastic) and saturate with Wet-Out using spreader. Ensure fabric is completely saturated then squeegee out excess resin. Role fabric on cardboard tube or roller.	INITIAL:
Fabric Application	Install saturated fabric by centering fabric over repair. Wrap around with consistent uniform pressure. Ensure fabric is snug around pipe. Two wraps will give the minimal 2 required layers of fabric. More layers will provide additional structural support. Leave 1" exposed primer on either side of fabric. Any entrapped air is worked out of fabric by applying pressure via spreader.	INITIAL:

Visual Inspection	Visual inspection completed in accordance with ASME PCC-2, Part 4, Article 4.1, Section 5	INITIAL:
Hardness Test	Hardness requirements of the composite wrap meet Shore D/Barcol requirements.	INITIAL:
Signature:		
Printed Name:		
<b>** Please provide photos before, during and after application for quality records.</b>		

**APPENDIX P - DATASHEETS**

 	Flowmeter Instrument			DATA SHEET NO.		REV.
	Magnetic			DST-R810-FIT-1A		0
	NO.	DATE	REVISION	SHEET	1	OF
0	2021-09-16	Issued for Tender	BY	CHK'D	PROC.	APPR.
			AA	TB		

<b>Project:</b>	NEWPCC Return Activated Sludge Piping System Refurbishment					
<b>TAG NO:</b>	R810-FIT-1A	Serial No:	TBD		Loop Wiring Diagrams:	
		Spec No:	TBD		Line / Vessel Number:	
Asset No:		P&ID:	1-0101R-A0094		Line ID:	Ø500 Nom., DN500/NPS 20" ASME B36.10 IPS:XS
Description:	MAGNETIC FLOWMETER - RAS 1A				Manufacturer:	Siemens
				Model:	MAG 3100/ MAG 6000 Transmitter	
Purchase Order:	TBD		Vendor:	Trans-West Inc.		
Requisition Number:	TBD		Job Number:	21-0107-001		

Fluid:	Return Activated Sludge (RAS)
Fluid State:	Liquid/Solid

PROCESS CONDITIONS	Process Data Case (Flow):	Minimum:	Normal (Operating):	Maximum (Full Scale):	Units:
	Flow:	2.255	8.16	25.465	m³/min
	Pressure:	0	135	405	kPa
	Temperature:	6.86	14.51	19.78	°C
	Design Pressure:	405	kPa	Vapor Pressure Pv:	
	Design Temperature:	19.78	°C	Compressibility (Z):	Incompressible
	Lower SG / Density:	4500	mg/L	Lower Viscosity:	Water
	Higher SG / Density:	17350	mg/L	Higher Viscosity:	Water
	Pipe Rating:	#150		Ambient Temperature:	10 °C
	Pipe Material:	Carbon Steel		Area Classification:	Ordinary
Special Condition:	0.90% Slurry (Max 1.74%)				

METER	Connection Size:	DN500/NPS 20" ASME B16.5 Class:150	Mounting Orientation:	Horizontal		
	Connection Type:	Flange	Mounting Kit:	Note 2		
	Tube Material:	Stainless steel	Flange / Wafer Rating:	ANSI B 16.5, Class 150		
	Lining Material:	PTFE	Flange Type:	Raised Face		
	Lining Protector:	Note 2	Flange Material:	Carbon Steel		
	Electrode Type:	Note 2	Allow. Operating Velocity:	0.1	to	117.81 m³/min
	Electrode Material:	Nickel alloy (Hastelloy C276)	Enclosure Class:	IP67 (NEMA 4X)		
	Grounding Rings:	Required (Note 2)	Safety Approvals:	Note 2		

TRANSMITTER	Stainless Steel Tag:	R810-FIT-1A	Wetted O-Ring Material:	N/A		
	Application:	Wastewater	Fill Fluid:	N/A		
	Type:	Electromagnetic Induction	Elevation:	N/A		
	Enclosure Class:	NEMA 4X	Suppression:	N/A		
	Housing:	IP66/NEMA 4X	Instrument Range:	0	to	35 m³/min
	Mounting:	Remote - Wall Mount	Calibration Range:	0	to	35 m³/min
	Signal / Protocol:	4-20 mA / HART	Controller Display Range:	0	to	35 m³/min
	Power Supply:	240 Vac	Static Pressure Range:	0	to	405 kPag
	Electrical Connection:	1/2 inch NPT	Allow. Oper Pressure:	0.01	to	100 bar
	Accuracy:	0.2 %± 1 mm/s	Allow. Oper Temperature:	-20	to	70 °C
Response Time:	50ms	Maximum Static Pressure	405 kPag			
Element Material:	Note 2					

OPTIONS	Integral Meter:	No	Hydrostatic Testing:	No
			Mounting Brackets:	Yes

NOTES	1. Delivery lead time shall not exceed 6 weeks.
	2. Details to be provided by instrument vendor.
	3. Instrument shall be supplied with a minimum 2 year warranty.

 	Flowmeter Instrument			DATA SHEET NO.		REV.
	Magnetic			DST-R815-FIT-1B		0
	NO.	DATE	REVISION	SHEET	1	OF
0	2021-09-16	Issued for Tender	BY	CHK'D	PROC.	APPR.
			AA	TB		

<b>Project:</b>	NEWPCC Return Activated Sludge Piping System Refurbishment					
<b>TAG NO:</b>	R815-FIT-1B	Serial No:	TBD		Loop Wiring Diagrams:	
		Spec No:	TBD		Line / Vessel Number:	
Asset No:		P&ID:	1-0101R-A0094		Line ID:	Ø500 Nom., DN500/NPS 20" ASME B36.10 IPS:XS
Description:	MAGNETIC FLOWMETER - RAS 1B				Manufacturer:	Siemens
		Model:	Mag3100/ Mag 6000 Transmitter			
Purchase Order:	TBD		Vendor:	Trans-West Inc.		
Requisition Number:	TBD		Job Number:	21-0107-001		

Fluid:	Return Activated Sludge (RAS)
Fluid State:	Liquid/Solid

PROCESS CONDITIONS	Process Data Case (Flow):	Minimum:	Normal (Operating):	Maximum (Full Scale):	Units:
	Flow:	2.255	8.16	25.465	m³/min
	Pressure:	0	135	405	kPa
	Temperature:	6.86	14.51	19.78	°C
	Design Pressure:	405	kPa	Vapor Pressure Pv:	
	Design Temperature:	19.78	°C	Compressibility (Z):	Incompressible
	Lower SG / Density:	4500	mg/L	Lower Viscosity:	Water
	Higher SG / Density:	17350	mg/L	Higher Viscosity:	Water
	Pipe Rating:	#150		Ambient Temperature:	10 °C
	Pipe Material:	Carbon Steel		Area Classification:	Ordinary
Special Condition:	0.90% Slurry (Max 1.74%)				

METER	Connection Size:	DN500/NPS 20" ASME B16.5 Class:150	Mounting Orientation:	Horizontal		
	Connection Type:	Flange	Mounting Kit:	Note 2		
	Tube Material:	Stainless steel	Flange / Wafer Rating:	ANSI B 16.5, Class 150		
	Lining Material:	PTFE	Flange Type:	Raised Face		
	Lining Protector:	Note 2	Flange Material:	Carbon Steel		
	Electrode Type:	Note 2	Allow. Operating Velocity:	0.1	to	117.81 m³/min
	Electrode Material:	Nickel alloy (Hastelloy C276)	Enclosure Class:	IP67 (NEMA 4X)		
	Grounding Rings:	Required (Note 2)	Safety Approvals:	Note 2		

TRANSMITTER	Stainless Steel Tag:	R815-FIT-1B	Wetted O-Ring Material:	N/A		
	Application:	Wastewater	Fill Fluid:	N/A		
	Type:	Electromagnetic Induction	Elevation:	N/A		
	Enclosure Class:	NEMA 4X	Suppression:	N/A		
	Housing:	IP66/NEMA 4X	Instrument Range:	0	to	35 m³/min
	Mounting:	Remote - Wall Mount	Calibration Range:	0	to	35 m³/min
	Signal / Protocol:	4-20 mA / HART	Controller Display Range:	0	to	35 m³/min
	Power Supply:	240 Vac	Static Pressure Range:	0	to	405 kPag
	Electrical Connection:	1/2 inch NPT	Allow. Oper Pressure:	0.01	to	100 bar
	Accuracy:	0.2 %± 1 mm/s	Allow. Oper Temperature:	-20	to	70 °C
Response Time:	50ms	Maximum Static Pressure	405 kPag			
Element Material:	Note 2					

OPTIONS	Integral Meter:	No	Hydrostatic Testing:	No
			Mounting Brackets:	Yes

NOTES	1. Delivery lead time shall not exceed 6 weeks.
	2. Details to be provided by instrument vendor.
	3. Instrument shall be supplied with a minimum 2 year warranty.

<b>Project:</b>	NEWPCC Return Activated Sludge Piping System Refurbishment					
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<b>TAG NO:</b>	<b>R820-FIT-2A</b>	Serial No:	TBD		Loop Wiring Diagrams:		
		Spec No:	TBD		Line / Vessel Number:		
<b>Asset No:</b>		P&ID:	1-0101R-A0095		Line ID:	Ø500 Nom., DN500/NPS 20" ASME B36.10 IPS:XS	
<b>Description:</b>	MAGNETIC FLOWMETER - RAS 2A				Manufacturer:	Siemens	
					Model:	Mag3100/ Mag 6000 Transmitter	
<b>Purchase Order:</b>	TBD			<b>Vendor:</b>	Trans-West Inc.		
<b>Requisition Number:</b>	TBD			<b>Job Number:</b>	21-0107-001		

<b>Fluid:</b>	Return Activated Sludge (RAS)						
<b>Fluid State:</b>	Liquid/Solid						

PROCESS CONDITIONS	<b>Process Data Case (Flow):</b>	Minimum:	Normal (Operating):		Maximum (Full Scale):		Units:
	Flow:	2.255	5.74		20.01		m <sup>3</sup> /min
	Pressure:	0	135		405		kPa
	Temperature:	6.86	14.51		19.78		°C
	Design Pressure:	405	kPa	Vapor Pressure Pv:			
	Design Temperature:	19.78	°C	Compressibility (Z):	Incompressible		
	Lower SG / Density:	4500	mg/L	Lower Viscosity:	Water		
	Higher SG / Density:	17350	mg/L	Higher Viscosity:	Water		
	Pipe Rating:	#150		Ambient Temperature:	10	°C	
	Pipe Material:	Carbon Steel		Area Classification:	Ordinary		
Special Condition:	0.90% Slurry (Max 1.74%)						

METER	<b>Connection Size:</b>	DN500/NPS 20" ASME B16.5 Class:150		<b>Mounting Orientation:</b>	Horizontal			
	<b>Connection Type:</b>	Flange		<b>Mounting Kit:</b>	Note 2			
	<b>Tube Material:</b>	Stainless steel		<b>Flange / Wafer Rating:</b>	ANSI B 16.5, Class 150			
	<b>Lining Material:</b>	PTFE		<b>Flange Type:</b>	Raised Face			
	<b>Lining Protector:</b>	Note 2		<b>Flange Material:</b>	Carbon Steel			
	<b>Electrode Type:</b>	Note 2		<b>Allow. Operating Velocity:</b>	0.1	to	117.81	m <sup>3</sup> /min
	<b>Electrode Material:</b>	Nickel alloy (Hastelloy C276)		<b>Enclosure Class:</b>	IP67 (NEMA 4X)			
	<b>Grounding Rings:</b>	Required (Note 2)		<b>Safety Approvals:</b>	Note 2			

TRANSMITTER	<b>Stainless Steel Tag:</b>	R820-FIT-2A		<b>Wetted O-Ring Material:</b>	N/A			
	<b>Application:</b>	Wastewater		<b>Fill Fluid:</b>	N/A			
	<b>Type:</b>	Electromagnetic Induction		<b>Elevation:</b>	N/A			
	<b>Enclosure Class:</b>	NEMA 4X		<b>Suppression:</b>	N/A			
	<b>Housing:</b>	IP66/NEMA 4X		<b>Instrument Range:</b>	0	to	35	m <sup>3</sup> /min
	<b>Mounting:</b>	Remote - Wall Mount		<b>Calibration Range:</b>	0	to	35	m <sup>3</sup> /min
	<b>Signal / Protocol:</b>	4-20 mA / HART		<b>Controller Display Range:</b>	0	to	35	m <sup>3</sup> /min
	<b>Power Supply:</b>	240 Vac		<b>Static Pressure Range:</b>	0	to	405	kPag
	<b>Electrical Connection:</b>	1/2 inch NPT		<b>Allow. Oper Pressure:</b>	0.01	to	100	bar
	<b>Accuracy:</b>	0.2 %± 1 mm/s		<b>Allow. Oper Temperature:</b>	-20	to	70	°C
<b>Response Time:</b>	50ms		<b>Maximum Static Pressure:</b>	405			kPag	
<b>Element Material:</b>	Note 2							

OPTIONS	<b>Integral Meter:</b>	No		<b>Hydrostatic Testing:</b>	No		
	<b>Scale:</b>			<b>Mounting Brackets:</b>	Yes		

NOTES	1. Delivery lead time shall not exceed 6 weeks.
	2. Details to be provided by instrument vendor.
	3. Instrument shall be supplied with a minimum 2 year warranty.

 		<b>Flowmeter Instrument</b> <b>Magnetic</b>				DATA SHEET NO.		REV.		
						DST-R825-FIT-2B		0		
<b>Project:</b> NEWPCC Return Activated Sludge Piping System Refurbishment		NO.	DATE	REVISION		BY	CHK'D	PROC.	APPR.	
		0	2021-09-16	Issued for Tender		AA	TB			
<b>TAG NO:</b> R825-FIT-2B		Serial No:	TBD		Loop Wiring Diagrams:					
		Spec No:	TBD		Line / Vessel Number:					
<b>Asset No:</b>		P&ID:	1-0101R-A0095		Line ID:	Ø500 Nom., DN500/NPS 20" ASME B36.10 IPS:XS				
<b>Description:</b> MAGNETIC FLOWMETER - RAS 2B					Manufacturer:	Siemens				
					Model:	Mag3100/ Mag 6000 Transmitter				
<b>Purchase Order:</b>		TBD		<b>Vendor:</b>		Trans-West Inc.				
<b>Requisition Number:</b>		TBD		<b>Job Number:</b>		21-0107-001				
<b>Fluid:</b>		Return Activated Sludge (RAS)								
<b>Fluid State:</b>		Liquid/Solid								
<b>PROCESS CONDITIONS</b>	<b>Process Data Case (Flow):</b>		Minimum:	Normal (Operating):		Maximum (Full Scale):		Units:		
	<b>Flow:</b>		2.255	5.74		20.01		m³/min		
	<b>Pressure:</b>		0	135		405		kPa		
	<b>Temperature:</b>		6.86	14.51		19.78		°C		
	<b>Design Pressure:</b>		405	kPa	<b>Vapor Pressure Pv:</b>					
	<b>Design Temperature:</b>		19.78	°C	<b>Compressibility (Z):</b>		Incompressible			
	<b>Lower SG / Density:</b>		4500	mg/L	<b>Lower Viscosity:</b>		Water			
	<b>Higher SG / Density:</b>		17350	mg/L	<b>Higher Viscosity:</b>		Water			
	<b>Pipe Rating:</b>		#150		<b>Ambient Temperature:</b>		10		°C	
	<b>Pipe Material:</b>		Carbon Steel		<b>Area Classification:</b>		Ordinary			
<b>Special Condition:</b>		0.90% Slurry (Max 1.74%)								
<b>METER</b>	<b>Connection Size:</b>		DN500/NPS 20" ASME B16.5 Class:150		<b>Mounting Orientation:</b>		Horizontal			
	<b>Connection Type:</b>		Flange		<b>Mounting Kit:</b>		Note 2			
	<b>Tube Material:</b>		Stainless steel		<b>Flange / Wafer Rating:</b>		ANSI B 16.5, Class 150			
	<b>Lining Material:</b>		PTFE		<b>Flange Type:</b>		Raised Face			
	<b>Lining Protector:</b>		Note 2		<b>Flange Material:</b>		Carbon Steel			
	<b>Electrode Type:</b>		Note 2		<b>Allow. Operating Velocity:</b>		0.1	to	117.81	m³/min
	<b>Electrode Material:</b>		Nickel alloy (Hastelloy C276)		<b>Enclosure Class:</b>		IP67 (NEMA 4X)			
	<b>Grounding Rings:</b>		Required (Note 2)		<b>Safety Approvals:</b>		Note 2			
<b>TRANSMITTER</b>	<b>Stainless Steel Tag:</b>		R825-FIT-2B		<b>Wetted O-Ring Material:</b>		N/A			
	<b>Application:</b>		Wastewater		<b>Fill Fluid:</b>		N/A			
	<b>Type:</b>		Electromagnetic Induction		<b>Elevation:</b>		N/A			
	<b>Enclosure Class:</b>		NEMA 4X		<b>Suppression:</b>		N/A			
	<b>Housing:</b>		IP66/NEMA 4X		<b>Instrument Range:</b>		0	to	35	m³/min
	<b>Mounting:</b>		Remote - Wall Mount		<b>Calibration Range:</b>		0	to	35	m³/min
	<b>Signal / Protocol:</b>		4-20 mA / HART		<b>Controller Display Range:</b>		0	to	35	m³/min
	<b>Power Supply:</b>		240 Vac		<b>Static Pressure Range:</b>		0	to	405	Kpag
	<b>Electrical Connection:</b>		1/2 inch NPT		<b>Allow. Oper Pressure:</b>		0.01	to	100	bar
	<b>Accuracy:</b>		0.2 %± 1 mm/s		<b>Allow. Oper Temperature:</b>		-20	to	70	°C
	<b>Response Time:</b>		50ms		<b>Maximum Static Pressure:</b>		405		Kpag	
<b>Element Material:</b>		Note 2								
<b>OPTIONS</b>	<b>Integral Meter:</b>		No		<b>Hydrostatic Testing:</b>		No			
					<b>Mounting Brackets:</b>		Yes			
<b>NOTES</b>	1. Delivery lead time shall not exceed 6 weeks.									
	2. Details to be provided by instrument vendor.									
	3. Instrument shall be supplied with a minimum 2 year warranty.									

<b>Project:</b>	NEWPCC Return Activated Sludge Piping System Refurbishment					
<b>TAG NO:</b>	<b>R830-FIT-3A</b>	Serial No:	TBD		Loop Wiring Diagrams:	
		Spec No:	TBD		Line / Vessel Number:	
<b>Asset No:</b>		P&ID:	1-0101R-A0096		Line ID:	Ø500 Nom., DN500/NPS 20" ASME B36.10 IPS:XS
<b>Description:</b>	MAGNETIC FLOWMETER - RAS 3A				Manufacturer:	Siemens
					Model:	Mag3100/ Mag 6000 Transmitter
<b>Purchase Order:</b>	TBD		<b>Vendor:</b>	Trans-West Inc.		
<b>Requisition Number:</b>	TBD		<b>Job Number:</b>	21-0107-001		

<b>Fluid:</b>	Return Activated Sludge (RAS)
<b>Fluid State:</b>	Liquid/Solid

<b>PROCESS CONDITIONS</b>	<b>Process Data Case (Flow):</b>	Minimum:	Normal (Operating):	Maximum (Full Scale):	Units:
	<b>Flow:</b>	1.96	5.79	16.155	m <sup>3</sup> /min
	<b>Pressure:</b>	0	135	405	kPa
	<b>Temperature:</b>	6.86	14.51	19.78	°C
	<b>Design Pressure:</b>	405	kPa	<b>Vapor Pressure Pv:</b>	
	<b>Design Temperature:</b>	19.78	°C	<b>Compressibility (Z):</b>	Incompressible
	<b>Lower SG / Density:</b>	4500	mg/L	<b>Lower Viscosity:</b>	Water
	<b>Higher SG / Density:</b>	17350	mg/L	<b>Higher Viscosity:</b>	Water
	<b>Pipe Rating:</b>	#150		<b>Ambient Temperature:</b>	10 °C
	<b>Pipe Material:</b>	Carbon Steel		<b>Area Classification:</b>	Ordinary
<b>Special Condition:</b>	0.90% Slurry (Max 1.74%)				

<b>METER</b>	<b>Connection Size:</b>	DN500/NPS 20" ASME B16.5 Class:150	<b>Mounting Orientation:</b>	Horizontal
	<b>Connection Type:</b>	Flange	<b>Mounting Kit:</b>	Note 2
	<b>Tube Material:</b>	Stainless steel	<b>Flange / Wafer Rating:</b>	ANSI B 16.5, Class 150
	<b>Lining Material:</b>	PTFE	<b>Flange Type:</b>	Raised Face
	<b>Lining Protector:</b>	Note 2	<b>Flange Material:</b>	Carbon Steel
	<b>Electrode Type:</b>	Note 2	<b>Allow. Operating Velocity:</b>	0.1 to 117.81 m <sup>3</sup> /min
	<b>Electrode Material:</b>	Nickel alloy (Hastelloy C276)	<b>Enclosure Class:</b>	IP67 (NEMA 4X)
	<b>Grounding Rings:</b>	Required (Note 2)	<b>Safety Approvals:</b>	Note 2

<b>TRANSMITTER</b>	<b>Stainless Steel Tag:</b>	R830-FIT-3A	<b>Wetted O-Ring Material:</b>	N/A
	<b>Application:</b>	Wastewater	<b>Fill Fluid:</b>	N/A
	<b>Type:</b>	Electromagnetic Induction	<b>Elevation:</b>	N/A
	<b>Enclosure Class:</b>	NEMA 4X	<b>Suppression:</b>	N/A
	<b>Housing:</b>	IP66/NEMA 4X	<b>Instrument Range:</b>	0 to 35 m <sup>3</sup> /min
	<b>Mounting:</b>	Remote - Wall Mount	<b>Calibration Range:</b>	0 to 35 m <sup>3</sup> /min
	<b>Signal / Protocol:</b>	4-20 mA / HART	<b>Controller Display Range:</b>	0 to 35 m <sup>3</sup> /min
	<b>Power Supply:</b>	240 Vac	<b>Static Pressure Range:</b>	0 to 405 kPag
	<b>Electrical Connection:</b>	1/2 inch NPT	<b>Allow. Oper Pressure:</b>	0.01 to 100 bar
	<b>Accuracy:</b>	0.2 %± 1 mm/s	<b>Allow. Oper Temperature:</b>	-20 to 70 °C
<b>Response Time:</b>	50ms	<b>Maximum Static Pressure:</b>	405 kPag	
<b>Element Material:</b>	Note 2			

<b>OPTIONS</b>	<b>Integral Meter:</b>	No	<b>Hydrostatic Testing:</b>	No
			<b>Mounting Brackets:</b>	Yes

<b>NOTES</b>	1. Delivery lead time shall not exceed 6 weeks.
	2. Details to be provided by instrument vendor.
	3. Instrument shall be supplied with a minimum 2 year warranty.

<b>Project:</b>	NEWPCC Return Activated Sludge Piping System Refurbishment						
<b>TAG NO:</b>	<b>R835-FIT-3B</b>	Serial No:	TBD		Loop Wiring Diagrams:		
		Spec No:	TBD		Line / Vessel Number:		
<b>Asset No:</b>		P&ID:	1-0101R-A0096		Line ID:	Ø500 Nom., DN500/NPS 20" ASME B36.10 IPS:XS	
<b>Description:</b>	MAGNETIC FLOWMETER - RAS 3B				Manufacturer:	Siemens	
					Model:	Mag3100/ Mag 6000 Transmitter	
<b>Purchase Order:</b>	TBD			<b>Vendor:</b>	Trans-West Inc.		
<b>Requisition Number:</b>	TBD			<b>Job Number:</b>	21-0107-001		

<b>Fluid:</b>	Return Activated Sludge (RAS)						
<b>Fluid State:</b>	Liquid/Solid						

<b>PROCESS CONDITIONS</b>	<b>Process Data Case (Flow):</b>	Minimum:	Normal (Operating):		Maximum (Full Scale):	Units:
	<b>Flow:</b>	1.96	5.79		16.155	m <sup>3</sup> /min
	<b>Pressure:</b>	0	135		405	kPa
	<b>Temperature:</b>	6.86	14.51		19.78	°C
	<b>Design Pressure:</b>	405	kPa	<b>Vapor Pressure Pv:</b>		
	<b>Design Temperature:</b>	19.78	°C	<b>Compressibility (Z):</b>	Incompressible	
	<b>Lower SG / Density:</b>	4500	mg/L	<b>Lower Viscosity:</b>	Water	
	<b>Higher SG / Density:</b>	17350	mg/L	<b>Higher Viscosity:</b>	Water	
	<b>Pipe Rating:</b>	#150		<b>Ambient Temperature:</b>	10	°C
	<b>Pipe Material:</b>	Carbon Steel		<b>Area Classification:</b>	Ordinary	
<b>Special Condition:</b>	0.90% Slurry (Max 1.74%)					

<b>METER</b>	<b>Connection Size:</b>	DN500/NPS 20" ASME B16.5 Class:150		<b>Mounting Orientation:</b>	Horizontal		
	<b>Connection Type:</b>	Flange		<b>Mounting Kit:</b>	Note 2		
	<b>Tube Material:</b>	Stainless steel		<b>Flange / Wafer Rating:</b>	ANSI B 16.5, Class 150		
	<b>Lining Material:</b>	PTFE		<b>Flange Type:</b>	Raised Face		
	<b>Lining Protector:</b>	Note 2		<b>Flange Material:</b>	Carbon Steel		
	<b>Electrode Type:</b>	Note 2		<b>Allow. Operating Velocity:</b>	0.1	to 117.81	m <sup>3</sup> /min
	<b>Electrode Material:</b>	Nickel alloy (Hastelloy C276)		<b>Enclosure Class:</b>	IP67 (NEMA 4X)		
	<b>Grounding Rings:</b>	Required (Note 2)		<b>Safety Approvals:</b>	Note 2		

<b>TRANSMITTER</b>	<b>Stainless Steel Tag:</b>	R835-FIT-3B		<b>Wetted O-Ring Material:</b>	N/A		
	<b>Application:</b>	Wastewater		<b>Fill Fluid:</b>	N/A		
	<b>Type:</b>	Electromagnetic Induction		<b>Elevation:</b>	N/A		
	<b>Enclosure Class:</b>	NEMA 4X		<b>Suppression:</b>	N/A		
	<b>Housing:</b>	IP66/NEMA 4X		<b>Instrument Range:</b>	0	to 35	m <sup>3</sup> /min
	<b>Mounting:</b>	Remote - Wall Mount		<b>Calibration Range:</b>	0	to 35	m <sup>3</sup> /min
	<b>Signal / Protocol:</b>	4-20 mA / HART		<b>Controller Display Range:</b>	0	to 35	m <sup>3</sup> /min
	<b>Power Supply:</b>	240 Vac		<b>Static Pressure Range:</b>	0	to 405	kPag
	<b>Electrical Connection:</b>	1/2 inch NPT		<b>Allow. Oper Pressure:</b>	0.01	to 100	bar
	<b>Accuracy:</b>	0.2 %± 1 mm/s		<b>Allow. Oper Temperature:</b>	-20	to 70	°C
<b>Response Time:</b>	50ms		<b>Maximum Static Pressure</b>	405		kPag	
<b>Element Material:</b>	Note 2						

<b>OPTIONS</b>	<b>Integral Meter:</b>	No		<b>Hydrostatic Testing:</b>	No	
	<b>Scale:</b>			<b>Mounting Brackets:</b>	Yes	

<b>NOTES</b>	1. Delivery lead time shall not exceed 6 weeks.
	2. Details to be provided by instrument vendor.
	3. Instrument shall be supplied with a minimum 2 year warranty.

<b>Project:</b>	NEWPCC Return Activated Sludge Piping System Refurbishment					
<b>TAG NO:</b>	<b>S941-FIT</b>	Serial No:	TBD		Loop Wiring Diagrams:	N/A
		Spec No:	TBD		Line / Vessel Number:	
Asset No:		P&ID:	1-0101S-A0155		Line ID:	Ø150 Nom., DN150/NPS 6" ASME B36.10 IPS:XS
Description:	MAGNETIC FLOW METER - WAS HEADER 1				Manufacturer:	Siemens
				Model:	MAG 3100/ MAG 6000 Transmitter	
Purchase Order:	TBD		Vendor:	Trans-West Inc.		
Requisition Number:	TBD		Job Number:	21-0107-007		

Fluid:	Waste Activated Sludge (WAS)
Fluid State:	Liquid/Solid

PROCESS CONDITIONS	Process Data Case (Flow):	Minimum:	Normal (Operating):	Maximum (Full Scale):	Units:
	Flow:	0	0.674	1.377	m³/min
	Pressure:	0	135	405	kPa
	Temperature:	6.86	14.51	19.78	°C
	Design Pressure:	405	kPa	Vapor Pressure Pv:	
	Design Temperature:	19.78	°C	Compressibility (Z):	Incompressible
	Lower SG / Density:	4500	mg/L	Lower Viscosity:	Water
	Higher SG / Density:	17350	mg/L	Higher Viscosity:	Water
	Pipe Rating:	#150		Ambient Temperature:	10 °C
	Pipe Material:	Carbon steel		Area Classification:	Ordinary
Special Condition:	0.90% Slurry (Max 1.74%)				

METER	Connection Size:	DN150/NPS 6" ASME B16.5 Class:150	Mounting Orientation:	Horizontal
	Connection Type:	Flange	Mounting Kit:	Note 3
	Tube Material:	Stainless steel	Flange / Wafer Rating:	ANSI B 16.5, Class 150
	Lining Material:	PTFE	Flange Type:	Raised Face
	Lining Protector:	Note 3	Flange Material:	Carbon Steel
	Electrode Type:	Note 3	Allow. Operating Velocity:	0.1 to 10 m³/min
	Electrode Material:	Nickel alloy (Hastelloy C276)	Enclosure Class:	IP67 (NEMA 4X)
	Grounding Rings:	Required (Model: A5E01191964)	Safety Approvals:	CSA

TRANSMITTER	Stainless Steel Tag:	S941-FIT	Wetted O-Ring Material:	N/A
	Application:	Wastewater	Fill Fluid:	N/A
	Type:	Electromagnetic Induction	Elevation:	N/A
	Enclosure Class:	NEMA 4X	Suppression:	N/A
	Housing:	IP66/NEMA 4X	Instrument Range:	0 to 2 m³/min
	Mounting:	Remote - Wall Mount	Calibration Range:	0 to 2 m³/min
	Signal / Protocol:	4-20 mA / HART	Controller Display Range:	0 to 2 m³/min
	Power Supply:	120 Vac	Static Pressure Range:	0 to 405 kPag
	Electrical Connection:	1/2 inch NPT	Allow. Oper Pressure:	0.01 to 100 bar
	Accuracy:	0.2 %± 1 mm/s	Allow. Oper Temperature:	-20 to 70 °C
Response Time:	50ms	Maximum Static Pressure	405 kPag	
Element Material:	Note 3			

OPTIONS	Integral Meter:	No	Hydrostatic Testing:	No
			Mounting Brackets:	Yes

- |       |   |
|-------|---|
| NOTES | 1. Not used.  |
|       | 2. Delivery lead time shall not exceed 6 weeks.                 |
|       | 3. Details to be provided by instrument vendor.                 |
|       | 4. Instrument shall be supplied with a minimum 2 year warranty. |
|       |   |
|       |   |



# Flowmeter Instrument

DATA SHEET NO.

REV.

DST-S942-FIT

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## Magnetic

SHEET 1 OF 1  
BY AA CHK'D TB PROC. APPR.

NO.	DATE	REVISION	BY	CHK'D	PROC.	APPR.
0	2021-09-16	Issued for Tender	AA	TB		

**Project:** NEWPCC Return Activated Sludge Piping System Refurbishment

<b>TAG NO:</b>	<b>S942-FIT</b>	Serial No:	TBD	Loop Wiring Diagrams:	N/A
		Spec No:		Line / Vessel Number:	
<b>Asset No:</b>		P&ID:	1-0101S-A0155	Line ID:	Ø150 Nom., DN150/NPS 6" ASME B36.10 IPS:XS
<b>Description:</b>	MAGNETIC FLOWMETER - WAS HEADER 2			Manufacturer:	Siemens
		Model:	Mag3100/ Mag 6000 Transmitter		
<b>Purchase Order:</b>	TBD		<b>Vendor:</b>	Trans-West Inc.	
<b>Requisition Number:</b>	TBD		<b>Job Number:</b>	21-0107-001	

<b>Fluid:</b>	Waste Activated Sludge (WAS)
<b>Fluid State:</b>	Liquid/Solid

PROCESS CONDITIONS	Process Data Case (Flow):	Minimum:	Normal (Operating):	Maximum (Full Scale):	Units:
	Flow:	0	0.647	1.304	m <sup>3</sup> /min
	Pressure:	0	135	405	kPa
	Temperature:	0	14.51	19.78	°C
	Design Pressure:	405	kPa	Vapor Pressure Pv:	
Design Temperature:	19.78	°C	Compressibility (Z):	Incompressible	
Lower SG / Density:	4500	mg/L	Lower Viscosity:	Water	
Higher SG / Density:	17350	mg/L	Higher Viscosity:	Water	
Pipe Rating:	#150		Ambient Temperature:	10	°C
Pipe Material:	Carbon steel		Area Classification:	Ordinary	
Special Condition:	0.90% Slurry (Max 1.74%)				

METER	<b>Connection Size:</b>	DN150/NPS 6" ASME B16.5 Class:150	<b>Mounting Orientation:</b>	Horizontal
	<b>Connection Type:</b>	Flange	<b>Mounting Kit:</b>	Note 3
	<b>Tube Material:</b>	Stainless steel	<b>Flange / Wafer Rating:</b>	ANSI B 16.5, Class 150
	<b>Lining Material:</b>	PTFE	<b>Flange Type:</b>	Raised Face
	<b>Lining Protector:</b>	Note 3	<b>Flange Material:</b>	Carbon Steel
	<b>Electrode Type:</b>	Note 3	<b>Allow. Operating Velocity:</b>	0.1 to 10 m <sup>3</sup> /min
	<b>Electrode Material:</b>	Nickel ally (Hastelloy C276)	<b>Enclosure Class:</b>	IP67 (NEMA 4X)
	<b>Grounding Rings:</b>	Required (Model: A5E01191964)	<b>Safety Approvals:</b>	CSA

TRANSMITTER	<b>Stainless Steel Tag:</b>	S942-FIT	<b>Wetted O-Ring Material:</b>	N/A
	<b>Application:</b>	Wastewater	<b>Fill Fluid:</b>	N/A
	<b>Type:</b>	Electromagnetic Induction	<b>Elevation:</b>	N/A
	<b>Enclosure Class:</b>	NEMA 4X	<b>Suppression:</b>	N/A
	<b>Housing:</b>	IP66/NEMA 4X	<b>Instrument Range:</b>	0 to 2 m <sup>3</sup> /min
	<b>Mounting:</b>	Remote - Wall Mount	<b>Calibration Range:</b>	0 to 2 m <sup>3</sup> /min
	<b>Signal / Protocol:</b>	4-20 mA / HART	<b>Controller Display Range:</b>	0 to 2 m <sup>3</sup> /min
	<b>Power Supply:</b>	120 Vac	<b>Static Pressure Range:</b>	0 to 405 kPag
	<b>Electrical Connection:</b>	Note 3	<b>Allow. Oper Pressure:</b>	0.01 to 100 bar
	<b>Accuracy:</b>	0.2 %± 1 mm/s	<b>Allow. Oper Temperature:</b>	-20 to 70 °C
	<b>Response Time:</b>	50ms	<b>Maximum Static Pressure:</b>	405 kPag
<b>Element Material:</b>	Note 3			

OPTIONS	<b>Integral Meter:</b>	No	<b>Hydrostatic Testing:</b>	No
			<b>Mounting Brackets:</b>	Yes

NOTES	1. Not Used.
	2. Delivery lead time shall not exceed 6 weeks.
	3. Details to be provided by instrument vendor.
	4. Instrument shall be supplied with a minimum 2 year warranty.



# Flowmeter Instrument

DATA SHEET NO.

REV.

DST-S943-FIT

0

## Magnetic

SHEET 1 OF 1

NO. DATE REVISION BY CHK'D PROC. APPR.

0 2021-09-16 Issued for Tender AA TB

**Project:** NEWPCC Return Activated Sludge Piping System Refurbishment**TAG NO:** S943-FIT  
Serial No: TBD Loop Wiring Diagrams: N/A  
Spec No: TBD Line / Vessel Number:

Asset No: P&amp;ID: 1-0101S-A0155 Line ID: Ø200 Nom., DN200/NPS 8" ASME B36.10 IPS:XS

Description: MAGNETIC FLOWMETER - WAS HEADER 3  
Manufacturer: Siemens  
Model: Mag3100/ Mag 6000 Transmitter

Purchase Order: TBD Vendor: Trans-West Inc.

Requisition Number: TBD Job Number: 21-0107-007

Fluid: Waste Activated Sludge (WAS)  
Fluid State: Liquid/Solid

Process Data Case (Flow):	Minimum:	Normal (Operating):	Maximum (Full Scale):	Units:
Flow:	0	0.894	1.683	m <sup>3</sup> /min
Pressure:	0	134	405	kPa
Temperature:	6.86	14.51	19.78	°C

Design Pressure:	405	kPa	Vapor Pressure Pv:		
Design Temperature:	19.78	°C	Compressibility (Z):	Incompressible	
Lower SG / Density:	4500	mg/L	Lower Viscosity:	Water	
Higher SG / Density:	17350	mg/L	Higher Viscosity:	Water	
Pipe Rating:	#150		Ambient Temperature:	10	°C
Pipe Material:	Carbon steel		Area Classification:	Ordinary	
Special Condition:	0.90% Slurry (Max 1.74%)				

Connection Size:	DN200/NPS 8" ASME B16.5 Class:150	Mounting Orientation:	Horizontal
Connection Type:	Flange	Mounting Kit:	Note 3
Tube Material:	Stainless steel	Flange / Wafer Rating:	ANSI B 16.5, Class 150
Lining Material:	PTFE	Flange Type:	Raised Face
Lining Protector:	Note 3	Flange Material:	Carbon Steel
Electrode Type:	Note 3	Allow. Operating Velocity:	0.1 to 10 m <sup>3</sup> /min
Electrode Material:	Nickel alloy (Hastelloy C276)	Enclosure Class:	IP67 (NEMA 4X)
Grounding Rings:	Required (Model: A5E01191964)	Safety Approvals:	CSA

Stainless Steel Tag:	S943-FIT	Wetted O-Ring Material:	N/A
Application:	Wastewater	Fill Fluid:	N/A
Type:	Electromagnetic Induction	Elevation:	N/A
Enclosure Class:	NEMA 4X	Suppression:	N/A
Housing:	IP66/NEMA 4X	Instrument Range:	0 to 2 m <sup>3</sup> /min
Mounting:	Remote - Wall Mount	Calibration Range:	0 to 2 m <sup>3</sup> /min
Signal / Protocol:	4-20 mA / HART	Controller Display Range:	0 to 2 m <sup>3</sup> /min
Power Supply:	120 Vac	Static Pressure Range:	0 to 405 kPag
Electrical Connection:	1/2 inch NPT	Allow. Oper Pressure:	0.01 to 100 bar
Accuracy:	0.2 %± 1 mm/s	Allow. Oper Temperature:	0 to 70 °C
Response Time:	50ms	Maximum Static Pressure	405 kPag
Element Material:	Note 3		

Integral Meter:	No	Hydrostatic Testing:	No
		Mounting Brackets:	Yes

- NOTES**
1. Not Used.
  2. Delivery lead time shall not exceed 6 weeks.
  3. Details to be provided by instrument vendor.
  4. Instrument shall be supplied with a minimum 2 year warranty.

**APPENDIX Q - CITY OF WINNIPEG SOPs & SWPs**



## Chemical and Biological Substances Protocol

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AUTHORITY FOR PROTOCOL: Director of Human Resources

LAST UPDATED: July, 2018

### Protocol

CHEMICAL AND BIOLOGICAL SUBSTANCES SHALL BE USED, HANDLED, STORED AND DISPOSED OF IN A SAFE MANNER AS TO REDUCE THE RISK OF HARMFUL EXPOSURE.

#### A. PURPOSE OF PROTOCOL

- Ensure compliance with the Manitoba Workplace Safety and Health Act & Regulations.
- Establish requirements for assessment and control of chemical and biological hazards.
- Enhance the safety of employees working with chemical and biological substances.

#### B. KEY CONCEPTS

- The safety risk of chemical and biological substances in the workplace is directly related to the hazards associated with the substance and how it is used.
- Assessing the hazards and implementing appropriate control measures, including safe work procedures, will reduce the risk of harmful exposure.

#### C. CHEMICAL AND BIOLOGICAL SUBSTANCE DEFINITIONS

**Biological Substance** means a substance containing living organisms or parts of living organisms in their natural or modified forms.

**Chemical Substance** means any natural or artificial substance, whether in the form of a solid, liquid, gas or vapour, other than a biological substance.

**Control Measure** means steps taken to prevent harmful exposure.

**Exposure** means exposure through inhalation, ingestion, injection, skin or mucosal contact, absorption or other route of entry to the human body.

**(Material) Safety Data Sheet [(M)SDS]** means a written document prepared by the supplier or manufacturer that contains information about a hazardous product, including information related to the hazards associated with any use, handling or storage of the product in the workplace.

**Workplace Hazardous Materials Information System (WHMIS)** is Canada's national hazard communication standard. The key elements of the system are hazard classification, cautionary labelling of containers, the provision of (material) safety data sheets ((M)SDSs) and worker education and training programs.

## D. PROCEDURES

### 1. ACCESS TO (M)SDS

- (M)SDSs will be made available to employees online in the [City of Winnipeg SDS Access System](#).
- (M)SDSs will be available in hardcopy in workplaces where internet access is unavailable.

### 2. ASSESSMENTS

- Safety risk associated with the use, handling, storage and disposal of chemical and biological substances, as well as the potential for uncontrolled releases or spills must be assessed by supervisors in consultation with:
  - employees
  - the safety and health committee
  - departmental safety resources (as required)
- Assessments must be:
  - conducted in reference to information provided on the (M)SDS.
  - documented using the [Site Specific Risk Assessment and Control Worksheet](#).
  - updated when changes to the products, procedures or the workplace create a safety risk.

### 3. CONTROL MEASURES

- If a safety risk associated with a chemical and/or biological substance has been identified, control measures must be implemented to eliminate or minimize the risk.
- Control measures must include the development in writing and implementation of safe work procedures.
- Safe work procedures must:
  - Be specific for each substance and activity.
  - Be documented using the [Safe Work Procedure Template](#).
  - Include procedures for the safe use, handling, storage and disposal of substances.
  - Include requirements for use of control measures such as personal protective or other equipment.
  - Include procedures for responding to uncontrolled releases or spills.
  - Be made available to employees and the safety and health committee.
  - Be revised at least every three years or sooner if circumstances change to create safety risk.

#### 4. TRAINING

- All employees who work with or may be exposed to chemical and/or biological substances must be instructed on:
  - Workplace Hazardous Materials Information System (WHMIS)
  - How to access (M)SDSs
  - Safe work procedures

#### 5. UNCONTROLLED RELEASES OR SPILLS

- Will be immediately reported and investigated according to the [Workplace Safety Incident Protocol](#).

### E. KEY ROLES AND RESPONSIBILITIES

#### **Chief Administrative Officer (CAO)**

- Officially endorses the Chemical and Biological Substances Protocol.
- Ensures compliance with this protocol by holding departments accountable.

#### **Chief Officers/ Department Heads**

- Ensure employees receive appropriate training and resources to comply with this protocol.
- Hold managers, supervisors and employees accountable for assessing the risk associated with chemical or biological substances and implementing control measures including safe work procedures.

#### **Director of Human Resources**

- Directs or approves the implementation of necessary changes to this protocol.

#### **Supervisors**

- Assess chemical and biological hazards in consultation with employees and safety and health committees.
- Identify and implement appropriate control measures for chemical and biological hazards including safe work procedures.
- Make safe work procedures available to employees and the safety and health committee.
- Ensure that employees are provided with the required equipment and training to work safely.
- Ensure (M)SDS are readily accessible to safety and health committee members and employees who may be exposed to a controlled product.
- Ensure employees comply with the Chemical and Biological Substances Protocol and safe work procedures.

#### **Workplace Safety and Health Committees**

- Assist supervisors and employees in the assessment of chemical and biological hazards and the implementation of control measures including safe work procedures.
- Recommend chemical and biological safety training.

#### **Departmental Safety Resource Staff**

- Assist supervisors in the assessment of chemical and biological hazards and the implementation of control measures including safe work procedures.
- Recommend corrective actions to prevent safety incidents.

#### **Occupational Health Branch (of CSS)**

- Respond to employee chemical and biological health concerns.
- Develop and implement health surveillance programs as required.

#### **Organizational Safety and Occupational Hygiene Branch (of CSS)**

- Provide consultation to the departments regarding chemical and/or biological hazards and control measures.
- Provide occupational hygiene support and expertise to the organization.
- Coordinate and maintain the (M)SDS Access System.
- Research, develop and recommend city-wide systems and programs to enhance chemical and biological safety.

#### **Employees**

- Notify their supervisor of chemical and biological hazards.
- Recommend control measures including safe work procedures to eliminate or minimize chemical and biological safety risks.
- Follow the Chemical and Biological Substances Protocol and established safe work procedures.
- Immediately report workplace safety incidents to their supervisor.
- Make recommendations to their supervisors to prevent chemical and biological safety incidents.
- Participate in WHMIS and other training as required.
- Obtain, review and apply WHMIS information.

## **F. REFERENCES AND LINKS TO RELATED PROCEDURES**

- [HR-006 Safety, Health and Organizational Wellness](#)
- [HR-010 City of Winnipeg Organizational Safety Governance](#)
- [Asbestos Procedures and Guidelines](#)
- [Contractor Safety Procedures](#)
- [Lockout / Tagout Procedures](#)
- [Organizational Safety Code of Practice](#)
- [Organizational Safety Performance Measurement and Reporting Protocol](#)
- [Respiratory Protection Procedures](#)
- [Workplace Immunization Procedures](#)
- [Workplace Safety Incident Protocol](#)

- [Workplace Safety Inspection Protocol](#)
- [Workplace Safety Program Review Protocol](#)

## **G. AMENDMENTS**

*Supersedes Chemical Products Code of Practice, 2004*  
*Supersedes Chemical and Biological Substances Protocol, 2013*

## **H. REVIEW PROCESS**

The Director of Human Resources is accountable for implementing and reviewing this Protocol.

## **I. KEY CONTACTS**

Manager, Organizational Safety Services  
Manager, Safety, Health and Occupational Wellness  
Director, Human Resources



# CONTRACTOR SAFETY

## A SHARED RESPONSIBILITY

### PROCEDURES TO PROTECT SAFETY AND HEALTH IN THE WORKPLACE DURING CONTRACT WORK.

The following provides general information only. Should there be any inconsistency between the applicable contract and the contractor safety program information, the contract shall prevail.

Prepared by:  
Corporate Support Services Department  
Human Resource Planning and Services Division  
Organizational Safety and Occupational Hygiene Branch  
Last Revised: October 2018





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## INTRODUCTION

Procedures to protect safety and health in the workplace during contracted work are required by the *Manitoba Workplace Safety and Health Act*. These procedures must include criteria for evaluating and selecting contractors as well as monitoring contract work.

This document outlines the process used to evaluate, select and monitor contractors working for the City of Winnipeg and applies to:

- Construction contract with an estimated cost exceeding \$100,000.00
- Any contract work deemed as high safety risk by the City

The contract remains the governing document outlining the agreement between the parties and is not superseded or replaced by these procedures.



**Contractor  
Evaluation  
& Selection**

**Safe Work  
Planning**

**Contractor  
Monitoring**

**The City of Winnipeg’s contractor safety program consists of three main elements:**

1. **Evaluation and selection** of the contractor based on criteria established by the City.
2. Development of **Safe Work Plans** by the contractor which are reviewed by the City; and
3. **Monitoring** to ensure that contract work proceeds safely and according to agreed requirements.

## GENERAL DUTIES

The term “**contractor**” used in this information refers to the person (includes a partnership or an unincorporated association) who has been contracted by the City to direct the activities of one or more employers or self-employed persons involved in work.

In cases where a prime contractor has been identified for a construction project, contractor

requirements as outlined in this information apply to the prime contractor, who in turn is responsible to ensure every person involved in work on a project (including subcontractors) complies with the *Workplace Safety and Health Act & Regulations*.

For more information on the legal duties of employers, prime contractor and contractors see the *Manitoba Workplace Safety and Health Act*.

## ROLES & RESPONSIBILITIES

### Materials Management/ Legal Services

- Initiates the solicitation of competitive offers and manages the procurement of contracted services.
- Ensures appropriate safety and health program evidence is provided and evaluated prior to contractor selection.
- Manages the contractor selection process.
- Participates in regular contractor safety committee meetings to provide feedback, identify areas of concern and share information about contractor safety.

### Contract Administrator

- Acts as the primary contact with the contractor on matters of safety and health in consultation with the departmental safety resource.
- Submits evidence of acceptable safety and health programs on behalf of the contractor to the Organizational Safety and Occupational Hygiene Branch for their records.
- Provides contractors with safety and health information (e.g. safety orientation, site tours) and ensures effective ongoing communication.
- Receives and reviews Safe Work Plans submitted by contractors.
- Monitors contractors in reference to Safe Work Plans.
- Takes appropriate corrective action to address unsafe work practices as necessary.
- Recommends termination, suspension or debarment of contractors in cases of breach of contract leading to unsafe work conditions.
- Provides information regarding contractor activity to required on-site City stakeholders (e.g. supervisor of area where contract work is to be performed).
- Facilitates the sharing of information related to contractor safety.

### Organizational Safety & Occupational Hygiene Branch

- Provides support to the City's administration on contractor safety issues.
- Receives and reviews evidence of acceptable safety and health programs.
- Maintains listings of prequalified contractors and acceptable consultants.
- Recommends changes in direction, systems and/or processes related to the contractor safety program.
- Facilitates regular contractor safety committee meetings with departmental resource staff to provide feedback, identify areas of concern and share information about contractor safety.

### Departmental Safety Personnel

- Provides safety advice and support to contract administrators, supervisors, workers and safety committee members.
- Supports the contractor safety program and related systems, processes and activities.
- Identifies and responds to emerging trends and internal/external risks specific to contractor safety and recommends processes and systems to respond to the issue.
- Participates in regular contractor safety committee meetings to provide feedback, identify areas of concern and share information about contractor safety.

### Contractor

- Ensures a safe and healthy work environment at work sites.
- Submits evidence of acceptable safety and health programs to the contract administrator, or if a contract administrator has not yet been assigned, to the Organizational Safety and Occupational Hygiene Branch.
- Prepares and submits Safe Work Plans specific to the site/workplace to the contract administrator.



- Ensures effective ongoing communication with contract administrator concerning safety and health.
- Complies with all contractual and regulatory requirements concerning safety and health.
- Cooperates with all persons exercising a duty imposed by the contract and by the *Workplace Safety and Health Act*.
- Monitors safety as work progresses and responds to any issues in a timely fashion.
- Responds to safety concerns raised by contract administrators/City staff.
- Ensures appropriate corrective action is taken to address unsafe acts and conditions.

### **Prime Contractor- Construction Project**

*In cases where a prime contractor has been employed for a construction project, the following apply **in addition** to those outlined for contractors:*

- Ensures every person involved in work on a project complies with the *Workplace Safety and Health Act & Regulations*.
- Co-ordinates, organizes and oversees the performance of all work at the construction project site.

### **Supervisor (City of Winnipeg)**

- Takes immediate corrective action to address unsafe situations where such actions do not endanger themselves or others.
- Informs contract administrator and/or safety resources of safety and health concerns related to contract work.
- Ensures safety hazards are addressed before allowing work to continue.
- Consults with departmental safety resources when required.

### **Employees (City of Winnipeg)**

- Takes immediate corrective action to address imminently dangerous situations where such actions do not endanger themselves or others.
- Informs their supervisors of safety and health concerns related to the contract work.

### **Contractor Safety Committee (City of Winnipeg)**

- Reviews emerging trends, and internal/external contractor safety risks within the organization and departments.
- Recommends priorities and action plans to deal with contractor safety issues.

## CONTRACTOR EVALUATION & SELECTION

Contractor safety and health programs are evaluated independently to determine if they meet or exceed all elements required of a safety program under the *Workplace Safety and Health Act*.

### Option 1: [Safe Work Certified](#)

A program is considered acceptable if it has been certified to Safe Work Manitoba's Safe Work Certified standard (e.g. COR™/SECOR™)

### Option 2: [Independent Review](#)

Contractors can meet the contractor safety requirements through evaluation of their safety and health program by an [independent consultant](#) using the [Contractor Safety Program Evaluation Document](#). The template is based on the requirements of Manitoba's *Workplace Safety and Health Act*.

Independent workplace safety and health consultants satisfactory to the City include persons who:

- Have been approved to conduct independent audits for safety and health certification programs meeting SAFE Work Manitoba's SAFE Work Certified Standard (e.g. COR™/SECOR™)
- Hold professional designations such as Canadian Registered Safety Professional (CRSP) or equivalent.

Contractors who submit proof of an acceptable review are listed on the [Pre-qualified Contractors List](#). These programs are considered acceptable to the City for a three year period from the date of written confirmation.

#### KEY MESSAGE:

*The City of Winnipeg has established a process to evaluate contractors based on their ability to comply with Safety and Health Legislation.*

## SAFE WORK PLANNING

Prior to work beginning, safety and health information is exchanged between the contract administrator and the contractor including the evaluation of hazards and the steps required to minimize those hazards. This information is documented by the contractor and provided to the City of Winnipeg in the form of a Safe Work Plan at least 5 days prior to work beginning.

Safe Work Plans demonstrate that a contractor:

- Is aware of the hazards associated with the work; and
- Have appropriate control measures in place to deal with them.

Safe Work Plans are reviewed by the contract administrator with the assistance of the departmental safety resource as required.

#### KEY MESSAGE:

*Safe Work Plans are provided to the City by the contractor to ensure procedures are in place to deal with hazards.*

## Contact Information

The contract administrator and the contractor must ensure effective ongoing exchange of safety information as well as notification in the event of an incident or emergency situation.

It is recommended that project contacts are posted at the job site for contract work taking place at City of Winnipeg facilities to ensure this information is available to supervisors and employees working in the area.

## Site Orientation

Before contract work begins, site-specific safe work and emergency procedures are communicated to contractors by contract administrators in consultation with departmental safety resources as needed.

Contractors are also briefed on roles and responsibilities as well as the consequences of not adhering to the Safe Work Plan or any site-specific safe work procedures. This would

include the corrective action that will be taken to stop unsafe work and the subsequent remedial measures.

This is consistent with the duty to provide information that may affect the safety and health of a person at the workplace as per the *Manitoba Workplace Safety and Health Act*.

A sample contractor safety orientation checklist has been included as [Appendix A](#).

## Hazard Communication

Effective ongoing communication between the contract administrator, the contractor and any subcontractor groups is essential to identify situations that may arise during the course of work not originally discussed or identified. It is also important that changes to Safe Work Plans be made and communicated on an on-going basis as required.

Safety is an integral part of pre-work discussions and project meetings.

## MONITORING CONTRACTOR SAFETY

Safety is reviewed along with other aspects of contract work during site visits by the contract administrator. This is done to ensure that contractors follow the safety requirements of the City of Winnipeg as well as the Safe Work Plans for the work being done.

Contract administrators should consult with their departmental safety resource if they have questions or need assistance with the monitoring process.

The frequency of monitoring is determined by:

- The nature of work and the risks involved.
- The contractor's familiarity with the work being done and whether the work was done previously by the contractor for the City and without incident.
- The level of knowledge and the experience the contractor has with respect to the safe work and emergency procedures.
- Past safety performance of the contractor.

Safety monitoring can be random or announced, narrow in focus or more encompassing depending on the type of work being performed. If unsafe work is observed, corrective action is taken by the contract administrator or others.

Corrective action can range from work stoppage until appropriate control measures are implemented up to and including termination of the contract in extreme situations.

### KEY MESSAGE:

*The safety performance of contractors is monitored by the City using the contractor's Safe Work Plan.*

## RESPONDING TO SAFETY CONCERNS & FOLLOW-UP

If a City employee becomes aware of a safety concern involving contract work the first step is always to notify their direct supervisor. It is the supervisor's responsibility to evaluate and respond to the concern in a timely manner in consultation with safety resources and the contract administrator.

Contractors have the same obligations to their employees as any other employer in Manitoba. Where safety issues arise regarding contractor employees the concern will always be taken to the supervisor of the employees involved.

The City of Winnipeg has the right to require the contractor to resolve any safety issue raised to the City's satisfaction before work continues. This decision belongs to the contract administrator responsible for the project with support from any safety resource needed.

In circumstances where contract work could result in serious and imminent harm to a person, all employees are encouraged to take immediate corrective action to address the situation in a way that does not endanger themselves or others. This may mean stopping the work in progress and contacting their supervisor to address the situation with all stakeholders.

### KEY MESSAGE:

*Circumstances that could result in serious harm must be immediately addressed.*

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## CONTRACTOR SUSPENSION & DEBARMENT

The City of Winnipeg reserves the right to suspend and debar a contractor for unacceptable performance in accordance with the City of Winnipeg's Materials Management Policy.

Contract administrators are responsible for recommending appropriate corrective action for unacceptable safety performance.

Additional information can be found at: <http://citynet/matmgt/debar.stm>

## FURTHER INFORMATION

- Additional information on the contractor safety program at the City of Winnipeg can be found at: <http://www.winnipeg.ca/matmgt/Safety/default.stm>
- Visit the following site for more information regarding the Manitoba *Workplace Safety and Health Act* & Regulations: <http://safemanitoba.com/default.aspx>



## **CONTRACTOR SAFETY ORIENTATION CHECKLIST**

**Contract Number:** \_\_\_\_\_

**Contractor Name:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Contractor Representative:** \_\_\_\_\_

**Phone:** \_\_\_\_\_

**Contract Administrator:** \_\_\_\_\_

**Phone:** \_\_\_\_\_

**Worksite Address:** \_\_\_\_\_

<b>Review of Safety Standards, Codes of Practice and Procedures (as applicable)</b>			
	Organizational Safety Code of Practice		First aid procedures & contacts
	Project/ Emergency contacts		Workplace safety incident procedures
	Safe work procedures		Chemical safety & WHMIS
	Personal protective equipment (PPE)		Respectful Workplace Standard
	Fire safety / Emergency procedures		Use of entrances and rest rooms
	Site security/Visitor procedures		Hot Work Permit requirements
	Access restrictions and signs		Use of tools & equipment
	Fall protection & overhead work		Lock-out/Tag-out procedures
	Reporting & follow-up for hazards		Confined Space Entry
	Alcohol and Drug Standard		Workplace Violence Prevention and Response Standard
<b>Review of Additional Safety Items</b>			

\_\_\_\_\_  
**Signature of Contractor**

\_\_\_\_\_  
**Signature of Contract Administrator**

*As per the Manitoba Workplace Safety and Health Act, all information must be disclosed that may affect the safety and health of a person at the workplace.*





<b>SAFE WORK PROCEDURE</b>		Job: PPE – Fall Arrest System		
Division: Water Services		Branch: All		
Created by: WSD SWP Facilitating Group		Created Date: April 2, 2019	Revision Date:	Document No. <b>70</b>

**Approved by:**

**#176 Water Distribution Safety Committee**

**Management Co-Chair**  
Zeljko Bodiroga  
Louis Rivard

**Worker Co-Chair**  
Nic James  
Jordan Melnyk

**If an incident occurs:**

**Incident Type:**

**Procedure**

Emergency	Call 911 immediately and report the incident to your supervisor
Non critical incident	Report the incident to your supervisor
Equipment malfunction	Report the incident to your supervisor

**Hazards**

Flying Debris

Musculoskeletal Injuries (MSI)

Slips / Trips / Falls

Chemical Splash

Arc Flash

**Training**

**Personal Protective Equipment (PPE)**

**Tools/Supplies**

Fall Arrest  
WHMIS 2015  
Applicable SOPs and SWPs

Fall Harness  
Lanyard  
CSA Protective Footwear  
CSA Hearing Protection  
CSA Safety Eyewear  
CSA Hard hat  
Weather Appropriate Hi-Vis Clothing

First Aid Kit  
Anchor Point

**Safe Approach**

**Fall Arrest System**

- 1) The supervisor is responsible for ensuring that all workers are trained & understand this procedure.
- 2) The supervisor shall ensure that all employees under their direction use a complete fall arrest system when a hazard of falling 3 meters or more exists.
- 3) All employees who require a fall arrest system shall be instructed in the inspection, donning and use of all components before the worker uses the system.
- 4) The employee is responsible for ensuring that a complete fall arrest system is used where there is a hazard of falling 3 meters or more & that this procedure is followed as directed by the supervisor.
- 5) Fall arrest equipment must be used by trained personnel only, & all equipment should be inspected by the user before each use.
- 6) The fall arrest system consists of an approved full body harness and an approved lanyard.
- 7) All fall arrest system components shall be CSA approved and readily identified.

- 8) The length of the lanyard or the location of the anchor shall be so arranged that the worker can fall no farther than 1.2 meters. A retractable harness- mounted lanyard is the most acceptable method.
- 9) All fall arrest components shall be stored properly and kept in good condition.
- 10) Safety belts, harnesses, lanyards and lifelines shall not be knotted and shall not be allowed to become knotted or damaged.
- 11) Never wrap lanyards around sharp or rough anchor points.
- 12) Fall arrest equipment must not be altered in anyway.
- 13) Any equipment subjected to a fall must not be used again.
- 14) All synthetic materials must be protected from slag, hot sparks, open flames or other heat sources.
- 15) Maximum working load is 310 pounds, unless otherwise labeled.
- 16) The anchor or tie off point must be capable of supporting 5,000 pounds per worker.

**END**

Reference	Disclaimer
<p>The Manitoba Workplace Safety and Health Act W210  The Manitoba Workplace Safety and Health Regulations 217/2006</p> <ul style="list-style-type: none"> <li>- Part 2 General Duties</li> <li>- Part 4 General Workplace Requirements</li> <li>- Part 5 First Aid</li> <li>- Part 6 Personal Protective Equipment</li> <li>- Part 8 Musculoskeletal Injuries</li> <li>- Part 14 Fall Protection</li> <li>- Part 16 Machines, Tools, and, Robots</li> <li>- Part 35 WHMIS 2015</li> </ul> <p>Workplace Bulletins # 247 Recognizing MSI Risks  Workplace Bulletins # 253 Musculoskeletal Injury Risks Identification and Assessment</p>	<p>This document is uncontrolled when printed; See <a href="http://citynet/ww/HR/SH/default.stm">http://citynet/ww/HR/SH/default.stm</a> for the most current SWP.</p> <p>Government regulations take precedence; all workers should be familiar with these regulations.</p> <p>This procedure must be reviewed any time the task, equipment or materials change and at a minimum every three years.</p>

<b>SAFE WORK PROCEDURE</b>	<b>Job:</b> Fall Rescue Plan			
<b>Division:</b> Water Services	<b>Branch:</b> All			
<b>Created by:</b> WSD SWP Facilitating Group	<b>Created Date:</b> April 2, 2019	<b>Revision Date:</b>	<b>Document No.</b> <b>47</b>	

<b>Approved by:</b>			
<b>#176 Water Distribution Safety Committee</b>			
<b>Management Co-Chair</b> Zeljko Bodiroga Louis Rivard	<b>Worker Co-Chair</b> Nic James Jordan Melnyk		

<b>If an incident occurs:</b>	
<b>Incident Type:</b>	<b>Procedure</b>
Emergency	Call 911 immediately and report the incident to your supervisor
Non critical incident	Report the incident to your supervisor
Equipment malfunction	Report the incident to your supervisor

<b>Hazards</b>	
Inhalation of Chemicals / Toxins	Suspension Trauma
Inhalation of Smoke	
Slips / Trips / Falls	

<b>Training</b>	<b>Personal Protective Equipment (PPE)</b>	<b>Tools/Supplies</b>
Fall Protection First Aid WHMIS 2015 Applicable SOPs and SWPs	Gloves CSA Protective Footwear CSA Hearing Protection CSA Safety Eyewear CSA Hard hat Weather Appropriate Hi-Vis Clothing Fall Harness/Lanyard	First Aid Kit

<b>Safe Approach</b>
<b>Fall Rescue Plan</b>
<p><b>Self-Rescue:</b> Under no circumstances should self-rescue be initiated until the competent person on site assesses the fall victim's physical and mental condition. It is nearly impossible to verbally dissuade a fall victim from attempting self-rescue if he or she is eternalized, athletic and has a natural take-charge mentality. If the person working at heights makes proper choices in the equipment to be used and uses that equipment properly the fallen worker may perform a self-rescue which will include:</p> <ol style="list-style-type: none"> <li>1. A climb back up to the level from which he fell (a few inches to two or three feet)</li> <li>2. Return to the floor or ground and take all components of the fall protection system out of service</li> <li>3. Obtain medical treatment as may be required</li> <li>4. Bag and tag those components with the name, date and activity at the time of the fall and complete an incident report.</li> <li>5. Return the used components in the bag to the office for inspection</li> </ol> <p><b>Mechanical Aided Aerial Lift:</b></p>

1. A worker will get into the aerial lift and make sure that there is a second adjustable lanyard or a 3 foot lanyard available for the rescued worker
2. The aerial lift will be maneuvered into position and raised up under the worker to be rescued
3. Attach the second lanyard in the aerial lift to the worker being rescued
4. Disconnect the rescued worker from the impacted fall arrest equipment
5. Lower the worker to the ground
6. Take care of the rescued worker medically as needed.
7. Bag and tag those components with the name, date and activity at the time of the fall and complete an incident report.
8. Return the used components in the bag to the office for inspection.

Extension Ladders:

1. Obtain an extension ladder of sufficient height and place the ladder under the fallen ladder. Ensure that the ladder extends sufficiently above the height of the fallen worker.
2. The fallen worker will then climb onto the ladder to support himself.
3. An assessment of the fallen worker will then be made to determine if he should attempt to climb down the ladder or wait for assistance.
4. If the worker can climb down the ladder, then have the worker release the rope grab and climb down the ladder
5. If the worker cannot climb down the ladder have him wait until another means of assistance is available (man lift, 911).
6. Take care of the rescued worker medically as needed.
7. Bag and tag those components with the name, date and activity at the time of the fall and complete an incident report.
8. Return the used components in the bag to the office for inspection.

**END**

Reference	Disclaimer
The Manitoba Workplace Safety and Health Act W210 The Manitoba Workplace Safety and Health Regulations 217/2006 <ul style="list-style-type: none"> <li>- Part 2      General Duties</li> <li>- Part 4      General Workplace Requirements</li> <li>- Part 5      First Aid</li> <li>- Part 14     Fall Protection</li> <li>- Part 35     WHMIS</li> </ul>	This document is uncontrolled when printed; See <a href="http://citynet/ww/HR/SH/default.stm">http://citynet/ww/HR/SH/default.stm</a> for the most current SWP.  Government regulations take precedence; all workers should be familiar with these regulations.  This procedure must be reviewed any time the task, equipment or materials change and at a minimum 3 years



# JOB SAFETY PLANNING FORM

Assess hazards before beginning work and as hazards change

Water and Waste Department

Job \_\_\_\_\_

Date \_\_\_\_\_

Time \_\_\_\_\_

Crew # / Job # \_\_\_\_\_

**SITE EMERGENCY RESPONSE**



**Muster (Meeting) Point** \_\_\_\_\_

**Job Location** \_\_\_\_\_

**Emergency #** \_\_\_\_\_

**Utility #** \_\_\_\_\_

**Have the applicable Safe Work Procedures been reviewed by all employees?**  Yes  No **If no, please choose one of the following:**

Not available to view on-site.  There is not one created. **Other:** \_\_\_\_\_

**If no Safe Work Procedure has been created for this job, please contact your supervisor before starting work.**

**Third parties and subcontractors on site have reviewed this job safety plan and are aware of all hazards and controls in place.**

**All materials, tools and equipment are available and inspected for use.**

IDENTIFIED HAZARD	HAZARD RANKING	CONTROL(S)	CONTROL TO BE COMPLETED BY	COMPLETED
Slips / Trips				
Manual Lifting / Ergonomics				

Other Safety Concerns:

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**DO NOT SIGN UNTIL YOU UNDERSTAND AND AGREE WITH THIS JOB SAFETY PLAN**

**Employee Signature**

My signature confirms that I have reviewed the job safety plan with the job leader and affected employees, and am satisfied that as long as the work is done according to the plan, it will be done safely and according to industry standards and the law.

_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

**Job Leader Signature**

Print Name

Signature

**Management Review Initials**

Initials

My signature confirms that I have reviewed the job safety plan with workers/helpers/contractors, and am satisfied that as long as the work is done according to the plan, it will be done safely and according to industry standards and the law.

Physical/Mechanical Hazards	Environmental Hazards	Ergonomic Hazards	Critical Task:
Backhoe operation	Air quality	Awkward posture	Abatement Activities
Electrical power source	Animal/insect bite	Overexertion	Chemical Usage
Explosion, flame, fire	Asbestos	Repetitive motion	Confined Space Work
Fall from height	Biological/bacteria	Vibration	Construction Projects
Guard, barricade – improper/missing	Flooding	<b>Safe Work Guidelines</b>	Crane and Hoist Usage
Handling- pinch, crush, cut, shear, stab	H2S	Eye wash facilities provided	Electrical Work
Hand tools - not powered	Heat/cold exposure	First aid	Excavations
Hand tools - powered	Housekeeping	Harnesses inspected	Hazardous Substances
Improper hoist/lift/rigging	Leachate	Hoist/winch inspected	High Noise Activities
Overhead work	Low light	LOTO guidelines followed	Hot Work
Slips/trips/falls – snow, ice, rain	Noise	PPE – inspected and being worn	Respiratory Hazards
Traffic control – improper/missing	Spill/escape of substance	Trained to use tools and equipment	Stored Energy
Trench – soil and spoil pile instability	Weather conditions	Tools/equipment/vehicles inspected	Working at Heights
Utility contact – overhead/buried			

### Hazard Risk Assessment Matrix

		Severity of Consequence				
		Negligible	Minor	Serious	Fatal	Catastrophic
Likelihood of Occurrence	Most Likely	1	2	3	4	5
	Possible	1	2	3	4	4
	Conceivable	1	2	2	3	3
	Remote	1	1	2	2	2
	Inconceivable	1	1	1	1	1

Likelihood of Occurrence
Inconceivable = Practically Impossible
Remote = Unlikely
Conceivable = Quite Possible
Possible = Can be Expected
Most Likely = Certain to Occur

Severity of Consequence
Negligible = Minor Injury
Minor = First Aid
Serious = Hospital or Doctor Required
Fatal = Death
Catastrophic = Multiple Deaths

Hazard Risk Assessment Scoring System	
1	Very Low Risk
2	Low Risk
3	Moderate Risk
4	High Risk
5	Very High Risk

Was the work completed without incident? Yes  No

If No: Was the supervisor called? Yes  No

Is there or will there be additional reporting documentation as a result of the incident?

- Blue card
- Green card
- Other: \_\_\_\_\_

*\*Refer to WWD Safety and Health Bulletin "Workplace Safety Incidents" for reporting procedure & information\**

**Comments:**

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# Lockout/Tagout (LOTO) Procedures

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ALL ENERGY SOURCES TO MACHINERY, EQUIPMENT OR PROCESSES SHALL BE DE-ENERGIZED, LOCKED OUT AND TAGGED OUT TO PROTECT AGAINST ACCIDENTAL OR INADVERTENT OPERATION WHEN SUCH OPERATION COULD CAUSE A WORKPLACE SAFETY INCIDENT.

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**AUTHORITY FOR PROCEDURES:**  
MANAGER, SAFETY, HEALTH AND OCCUPATIONAL WELLNESS

**LAST UPDATED:** September 2017

## A. PURPOSE

- Prevent injury due to accidental or inadvertent release of hazardous energy.
- Establish responsibility for implementing lockout/tagout procedures.
- Ensure compliance with the Workplace Safety and Health Act and Regulations.

## B. DEFINITIONS

**Affected person means** an employee whose job requires them to operate or monitor a system, or work in an area in which servicing or maintenance is being performed under LOTO.

**Authorized person means** an individual who is qualified to control hazardous energy sources because of their knowledge, training, and experience and has been assigned to engage in such control.

**De-energization means** a process that is used to disconnect and isolate a system from a source of energy in order to prevent the release of that energy.

**Energy Isolating Device means** a mechanical device that physically prevents the transmission or release of energy, including but not limited to: a manually operated disconnect switch, circuit breaker, line valve, or block (Note: push buttons, selection switches and other circuit control switches are not considered energy-isolating devices).

**Hazardous Energy means** any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, gravitational, or other energy that can cause harm.

**Lockout means** placement of a lockout device on an energy-isolating device.

**Locking Device** means any device that has the ability to secure an energy-isolating device in a safe position.

**System** means a machine, equipment and/or process.

**Tagout** means a labelling process that is used when lockout is required.

## C. PRINCIPLES

- When a system is serviced, repaired, tested, cleaned, maintained, unjammed or adjusted, no employee shall perform work on the system until it has come to a complete stop and the employee performing work on the system has:
  - locked out and tagged out the system and removed and rendered safe any hazardous condition; or
  - otherwise rendered the system inoperative in a manner that prevents reactivation and provides protection that is equal to, or greater than the lockout/tagout described above.
- Employees will not perform work on a system that is to be serviced, repaired, tested, cleaned, maintained, unjammed or adjusted until:
  - the system is tested to ensure that it is de-energized; and
  - the employee is assured that it is inoperative.

***The basic steps for locking and tagging out a system include:***

1. Prepare for Shutdown
2. Notify Affected Personnel
3. Properly Shut Down Machine
4. Isolate all Energy Sources
5. Dissipate Residual/Stored Energy
6. Apply Lock-out Devices, Locks and Tags
7. Verify Total De-energization of all Energy Sources
8. Perform Maintenance or Service Activity
9. Remove Lockout/Tagout Devices

*All of these steps must be accomplished in accordance with established LOTO Procedures (see below).*

These steps are described in detail in [APPENDIX A – Basic Steps of Locking and Tagging out a System](#).

## D. PROCEDURES

### 1. ENERGY ISOLATING DEVICES

- Systems will be equipped with energy isolating devices which are identifiable, accessible and lockable in the off position only.
- Energy-isolating devices must be designed to accept a lockout device that will secure them in the isolated position.

- Energy isolation devices will be locked out when:
  - a guard is removed or a safety device rendered inoperable.
  - there could be contact with moving parts, energized circuits, or mechanical energy.
  - there could be release of stored energy or a pressurized system, or the discharge of a gas or liquid.
- When locking out a system, a lock and tag shall be applied to each energy isolating device.
- Locks shall:
  - be issued by The City of Winnipeg.
  - be of consistent design and colour throughout the trade/workgroup/facility.
  - be labelled to identify the owner of the lock.
  - have one single unique key controlled by the owner of the lock.
  - only be used in the facility for lockout.
- Tags shall:
  - be applied to at least one lock on the affected machine.
  - be labelled with:
    - the person's name and department.
    - reason for lockout.
  - be blaze orange in colour.

*Note: A tag must be applied to each energy source if locks are not labeled with the person's name.*

## 2. LOTO PROCEDURES

- All departments will;
  - identify sources of hazardous energy.
  - ensure energy sources have isolating devices which are identifiable, accessible and lockable in the off position only.
  - ensure energy sources have a means to release or control stored energy.
  - document and implement LOTO procedures for each source.
  - provide necessary instruction on LOTO procedures.
  - ensure LOTO procedures are readily accessible to employees.
- LOTO procedures will identify:
  - energy sources in need of control.
  - authorized persons.
  - location of energy sources and isolating devices.
  - personal protective and/or other safety equipment required.
  - how to safely:
    - lock out and/or release energy.
    - verify that the procedure was successful.
    - maintain the lockout if extended into a new work shift.

- safe work practices related to any additional hazards associated with the system (e.g. hazardous substances).

#### APPENDIX B – Sample LOTO Procedure

- All authorized and affected persons will be provided instruction on LOTO procedures.

### 3. REMOVAL OF LOCKS AND EMERGENCY SITUATIONS

- Only the person who applied a lock may remove that lock.
- If a person leaves the facility and leaves their lock on a machine, an attempt must be made to contact that person to determine why the lock was left on the machine.
- If required, a lock may be removed by a supervisor, providing the following procedure is followed:
  - attempts have been made to contact the owner of the lock.
  - it is determined that the machine is either safe to turn on or a replacement lock from someone of the same trade has been placed on the machine.
  - an [Emergency Lock Removal Form](#) has been completed and provided to the departmental safety resource.
  - the owner of the lock is notified as soon as possible.

### 4. MULTIPLE PERSON PROTECTION

- When more than one person is working on a machine, a hasp shall be used and each person must apply their own lock to each energy isolating device.
- Hasps may be linked together to allow for large group lockout scenarios.

*Note: use of a group lockout box is also acceptable.*

### 5. SHIFT TRANSFER PROCEDURE

- When work is being performed beyond the end of a shift, the lockout shall be transferred from personnel on the outgoing shift to personnel from the incoming shift:
  - A designated shift transfer person (e.g. supervisor) must place their locks on each isolating device.
  - Once the shift transfer person applies their locks, other personnel's locks may be removed.
  - Shift transfer person must remain on-site until the incoming shift arrives.
  - Person on the incoming shift will take responsibility for the lockout and apply their locks.
  - The shift transfer person's locks may be removed.
- At all times, there must be at least one lock on each energy isolating device.

## 6. WORKING ON ENERGIZED EQUIPMENT

- Departments must develop and implement safe work procedures for tasks where work on energized equipment is necessary (e.g. regular set-up, adjustment or cleaning of a machine which cannot be performed with energy removed).
- Employees who work on energized equipment will be provided instruction on associated safe work procedures, including hazards, controls and how to perform the job safely.
- If troubleshooting or repair is required on energized equipment for which there is no safe work procedure, the person who will be doing the work must:
  - complete the [Work on Energized Equipment Form](#).
  - post the completed form on the control panel of the equipment being serviced.
  - provide the form to their supervisor when the work is complete.

## E. KEY ROLES AND RESPONSIBILITIES

### Authorized Persons

- Identify sources of hazardous energy and methods of control.
- Ensure hazardous energy sources have energy isolating devices which are identifiable, accessible and lockable in the off position only.
- Ensure hazardous energy sources have a means to control stored energy.
- Develop and follow LOTO procedures
- Notify affected persons of LOTO procedures.
- Inform affected employees when LOTO will impact operations.
- Inform their supervisor immediately if lock out is not effective

### Supervisors

- Identify sources of hazardous energy.
- Ensure hazardous energy sources have isolating devices which are identifiable, accessible and lockable in the off position only.
- Ensure hazardous energy sources have a means to control stored energy.
- Ensure LOTO procedures are developed, verified, implemented and followed for systems in their area.
- Provide necessary personal protective equipment and any other equipment required for LOTO.
- Ensure that only authorized persons perform LOTO.
- Ensure employees receive necessary instruction on LOTO.
- Ensure that employees under their supervision follow LOTO procedures when required.

### Departmental Safety Resources

- Assist departments in recognizing sources of hazardous energy and developing LOTO procedures.

- Recommend actions to prevent safety incidents.
- Provide instruction on LOTO procedures.
- Provide support/consultation to supervisors as requested.

### **Workplace Safety and Health Committees**

- Assist supervisors and employees in recognizing sources of hazardous energy and implementing control measures including LOTO procedures.

### **Affected and Other Employees**

- Assist in the development of LOTO procedures.
- Follow LOTO procedures.
- Under no circumstances attempt to re-start any system that is LOTO or attempt to remove the LOTO on any system.
- Report any concerns associated with LOTO procedures and/or equipment.

### **Contractors**

- Follow LOTO procedures.
- Under no circumstances attempt to re-start any system that is LOTO or attempt to remove the LOTO on any system.
- Report any concerns associated with LOTO procedures and/or equipment.

## **F. REFERENCES AND LINKS TO RELATED PROCEDURES**

[HR-006 Safety, Health and Organizational Wellness](#)  
[HR-010 City of Winnipeg Organizational Safety Governance](#)  
[Organizational Safety Code of Practice](#)  
[Workplace Safety Incident Protocol](#)  
[Workplace Safety Inspection Protocol](#)  
[Contractor Safety Procedures](#)  
[Chemical and Biological Substances Protocol](#)  
[Working Alone Protocol](#)  
[Organizational Safety Performance Measurement and Reporting Protocol](#)  
[Workplace Safety Program Review Protocol](#)  
[Respiratory Protection Procedures](#)  
[Hearing Conservation Procedures](#)

## **G. AMENDMENTS**

None.

## **H. KEY CONTACTS**

Manager, Organizational Safety Services  
 Manager, Safety, Health and Occupational Wellness

## APPENDIX A – Basic Steps of Locking and Tagging out a System

1. **Prepare for Shutdown** – Before a shutdown can take place, all sources of hazardous energy must be identified and methods of control established. This involves development of specific LOTO procedures that outline how to lock and tag out a system safely.
2. **Notify Affected Personnel** – Authorized persons (or their supervisors) must advise those affected of the reasons for LOTO and any potential impacts on operations or monitoring. They must identify who is responsible for LOTO and who to contact for more information.

This includes:

- a. What is going to be locked/tagged out?
  - b. Why it is going to be locked/tagged out?
  - c. For approximately how long will the system be unavailable?
  - d. Who is responsible for the lockout/tag out?
  - e. Who to contact for more information?
3. **Properly Shut Down Machine** – If the system is operating it must be shutdown in accordance with manufacturer instructions. This involves ensuring controls are in the off position, and verifying that all moving parts such as flywheels, gears, and spindles have come to a complete stop.
  4. **Isolate all Energy Sources**– All energy sources must be isolated and residual energy dissipated in accordance with LOTO procedures.
    - a. *Electrical energy* - Switch electrical disconnects to the off position. Visually verify that the breaker connections are in the off position. Lock the disconnects into the off position.
    - b. *Hydraulic and Pneumatic potential energy* - Set the valves in the closed position and lock them into place. Bleed off the energy by opening the pressure relief valves, then closing the airlines.
    - c. *Mechanical potential energy* - carefully release energy from springs that may still be compressed. If this is not feasible, block the parts that may move if there is a possibility that the spring can transfer energy to it.
    - d. *Gravitational potential energy* - Use a safety block or pin to prevent the part of the system that may fall or move.
    - e. *Chemical energy* - locate chemical supply lines to the system and close and lockout the valves. Where possible, bleed lines and/or cap ends to remove chemicals from the system.
  5. **Dissipate Residual/Stored Energy – examples include:**
    - a. *Electrical energy* - To find a specific method to discharge a capacitor for the system in question, contact the manufacturer for guidance. Many systems with electrical components, motors, or switch gears contain capacitors. Capacitors store electrical energy. In some cases, capacitors hold a charge in order to release energy very rapidly (e.g., similar to the flash of a camera). In other cases,

capacitors are used to remove spikes and surges in order to protect other electrical components. Capacitors must be discharged in the lockout process in order to protect workers from electrical shock.

- b. *Hydraulic and Pneumatic potential energy* - Set the valves in the closed position and locking them into place only isolates the lines from more energy entering the system. In most cases, there will still be residual energy left in the lines as pressurized fluid. This residual energy can be removed by bleeding the lines through pressure relief valves. Contact the manufacturer for more specific details, or if no pressure relief valves are available, what other methods are available.
- c. *Mechanical potential energy* - Carefully release energy from springs that may still be compressed. If this is not possible, use blocks to hold the parts that may move if the energy is released
- d. *Gravitational potential energy* - If feasible, lower the part to a height where falling is impossible. If this is not possible, contact the manufacturer for guidance.
- e. *Chemical energy* - If available, bleed lines and/or cap ends to remove chemicals from the system.

#### **6. Apply Lock-out Devices, Locks and Tags**

- a. Lock out and tag the energy-isolating device with an assigned, individual lock. A worker will not be protected unless he/she uses his/her own padlock.
- b. If more than one worker is working on the same piece of equipment at the same time, each one should lock out the equipment, by placing a personal lock and tag on the group lockout device when he/she begins work, and should remove those devices when he/she stops working on the machine or equipment.
- c. Locks and tags should clearly show the name of the person who applied the device, the date, and the reason for the lockout. This identifies who is servicing the machinery or equipment. In a multiple lockout/tagout situation, it will also identify any worker(s) who may not have finished working.
- d. Locks and tags must be durable enough to withstand the environment in which they are to be used. Information on the locks and tags should remain legible.
- e. Locks must be substantial enough to prevent removal without the use of excessive force. Tags must be substantial enough to prevent accidental or inadvertent removal.
- f. Both locks and tags are to be standardized by colour, shape, or size. Tags should be easily recognized and provide appropriate information about the lockout.
- g. For some equipment it may be necessary to construct attachments to which locks can be applied. An example is a common hasp to cover an operating button. Tags must be attached to the energy isolating device(s) and to the normal operating control in such a manner as to prevent operation during the lockout

#### **7. Verification of Total De-energization of All Sources** – Verification must ensure energy has been isolated without creating other hazards. This may involve engaging or activating

system controls, visual inspection and/or testing of equipment, in accordance with LOTO procedures.

Verification can take place in several ways:

- a. The machine, equipment, or process controls (push buttons, switches, etc.) are engaged or activated and the result is observed. No result means isolation is verified. Return controls to safe position (off).
- b. Visual inspection of:
  - i. Electrical connections to ensure they are open.
  - ii. Suspended parts are lowered to a resting position or blocked to prevent movement.
  - iii. Other devices that restrain machine or process movement.
  - iv. Valve positioning for double block and bleed (for pipes or ducts) - closing two valves of a section of a line, and then bleeding (or venting) the section of the line between the two closed valves.
  - v. Presence of solid plate used to absolutely close a line - called line blanking (for pipes or ducts).
  - vi. Any other acceptable method of energy isolation.
- c. Testing of the equipment:
  - i. Test circuitry (should be done by a certified electrician) - however, equipment with capacitors needs to be cycled until all energy is drained.
  - ii. Check pressure gauges to ensure hydraulic and pneumatic potential energy has been removed.
  - iii. Check temperature gauges to ensure thermal energy has been discharged

*Lockout Interruption – If a system is locked/tagged and there is a need for testing or positioning of the equipment/process, the following steps should be followed:*

- *Clear the equipment/process of tools and materials.*
- *Ensure workers are a safe distance from any potential hazard.*
- *Remove locks/tags according to established procedure.*
- *Proceed with test.*
- *De-energize all systems and re-lock/re-tag the controls before resuming work*

**8. Perform Maintenance or Service Activity** – Complete the activity that required the LOTO procedure.

**9. Remove Lockout/Tag out devices** – To remove locks and tags from a system that is now ready to be put back into service, the following general procedure can be used:

- a. Inspect the work area to ensure all tools and items have been removed.
- b. Confirm that all employees and persons are safely located away from hazardous areas.
- c. Verify that controls are in a neutral position.
- d. Remove devices and re-energize machine.
- e. Notify affected employees that servicing is completed

# APPENDIX B – Sample LOTO Procedure

		<b>MODERN 2500M - Milling Machine</b>					
<b>Lockout/Tagout Procedure</b>							
ID#	MIL01	Facility:	FRG	Date Created	Oct-16	Revision No. 0	
Facility:	FRG	Location:	Machine Shop	Reviewed Date:			
<b>1</b>	<b>Lockout Points</b>	<b>WARNING</b> 	1. Hydraulic pressure can be stored in this equipment. Ensure pressure is bled off before servicing. 2. MIL01 has internal capacitors which can store electrical energy. Ensure to properly dissipate energy before servicing. 3. Main Electrical Supply is fed from Breaker # 1 in Panel PP-JJ, located on the North Wall outside of the Tire Shop.				
Lockout Application Process							
<b>1. Notify affected personnel. 2. Properly shut down machine. 3. Isolate all energy sources. 4. Apply lockout devices, locks &amp; tags. 5. Verify total de-energization of all sources.</b>							
<div style="display: flex; justify-content: space-around; align-items: center;">   </div>							
ENERGY SOURCE	LOCATION	PROCEDURE FOR LOCKING OUT AND/OR RELEASING ENERGIES	VERIFY PROCEDURE				
Electrical	<span style="border: 1px solid black; padding: 2px;">E-1</span>	Milling Machine main power control box.	MIL01 must not be operating. Turn OFF the main disconnect. Place lock and tag. Remove key from lock.				
<b>Restoring Equipment to Service</b>							
1	Inspect	Check the machine or equipment to ensure that nonessential items have been removed, and that the machine or equipment components are operationally intact.					
2	Check Area	Check the work area to ensure that all employees have been safely positioned or removed from the area.					
3	Verify	Verify that the controls are in the neutral or OFF position.					
4	Remove	Remove the lockout devices and reenergize the machine or equipment. In reverse order, follow all of the steps listed above. Note: the removal of some forms of blocking may require re-energization of the machine before safe removal.					
5	Notify	Notify affected employees that the servicing, maintenance or cleaning is completed and the machine or equipment is ready for use.					
<b>IF EQUIPMENT CANNOT BE LOCKED OUT, OR IF SYSTEM FAILS VERIFICATION. CONTACT YOUR SUPERVISOR</b>							

FOLLOW START UP PROCEDURES

FOLLOW SHUTDOWN PROCEDURES

## APPENDIX C – Emergency Lock Removal Form

### Emergency Lock Removal Form

*To be used if authorized person is unavailable and attempts to contact them were unsuccessful.*

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Machine Name: \_\_\_\_\_

Machine Location: \_\_\_\_\_

Name of employee whose lock was removed: \_\_\_\_\_

Reason lock was left on machine:

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Check one of the following:

Machine was safe to turn on

Replacement lock was placed on machine

Person authorizing removal of lock:

Name: \_\_\_\_\_ Signature: \_\_\_\_\_

**APPENDIX D – Sample Work on Energized Equipment Form**

**WORK ON ENERGIZED EQUIPMENT FORM**

***Troubleshooting:** Watching a machine cycle (guards on or off) or taking readings or measurements without having to come into contact with energized components. Machine must be locked out prior to commencing work.*

***Working On:** Coming into contact with energized or moving components.*

**Date:** \_\_\_\_\_ **Time:** \_\_\_\_\_

**Machine Name & Location:** \_\_\_\_\_

**Description of work:** \_\_\_\_\_

\_\_\_\_\_

**Reason why machine cannot be locked out:** \_\_\_\_\_

\_\_\_\_\_

In order to use this form, the following items must apply:

1. You must have previous experience working on this equipment.
2. You must be familiar with all the energy sources and hazards on this equipment.
3. You must have a way to protect yourself from all the hazards.
4. You must be trained on the City of Winnipeg lockout policy.
5. If working on an energized machine, a safety watcher must be present and shall never come in contact with the machine during the task

Identify the following hazards that apply to this equipment and explain how to control them:

1. Electrical: \_\_\_\_\_
2. Unexpected Start: \_\_\_\_\_
3. Moving Parts: \_\_\_\_\_
4. Sharp Objects: \_\_\_\_\_
5. Temperature: \_\_\_\_\_
6. Stored/Residual Energy: \_\_\_\_\_

Name of Person Performing Work: \_\_\_\_\_ Signature: \_\_\_\_\_

Name of Person Performing Work: \_\_\_\_\_ Signature: \_\_\_\_\_

*These signatures are required if "Working On" energized equipment (not "Troubleshooting"):*

Manager/Supervisor Name: \_\_\_\_\_ Signature: \_\_\_\_\_

Safety Watcher: \_\_\_\_\_ Signature: \_\_\_\_\_

*This form must be completed and posted on the machine control panel prior to commencement of work. Hand in form to supervisor when work is complete.*

## **APPENDIX R – WWD PAINT COLOUR STANDARD - R01**



**The City of Winnipeg**  
**North End Sewage Treatment Plant**

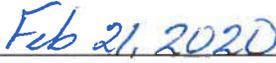
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**Paint Colour Standard**

Document Code:

Revision: 01

Approved By:		
	Duane Griffin, Branch Head - Wastewater Planning & Project Delivery	Date

 Winnipeg	<b>Paint Colour Standard</b>	Revision: 01	Page 2 of 19
		Document Code:	

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REVISION REGISTER				
Rev.	Description	Date	By	Approved
00	Issued for City Use	2020-02-18	K. Schimke	D. Griffin
01	Replaced "color" with "colour"	2020-02-21	K. Schimke	D. Griffin

 Winnipeg	<b>Paint Colour Standard</b>	Revision: 01	Page 4 of 19
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## 1 INTRODUCTION

This document identifies the standard paint colour requirements that are applicable to any work within the City of Winnipeg's North End Sewage Treatment Plant.

### 1.1 Scope of the Standard

This design standard will apply to the following facilities:

North End Sewage Treatment Plant

### 1.2 North End Sewage Treatment Plant Application

Existing facilities do not necessarily comply with this standard. The expectations regarding application of this standard to maintenance and minor upgrades at existing facilities must be assessed on a case-by-case basis; however general guidelines for application are presented as follows:

- All new facilities are expected to comply with this standard.
- All major upgrades to a facility are expected to comply with this standard; however in some cases compromise with the configuration of the existing facility design may be required.
- All minor upgrades should utilize this standard as far as practical for new work; however in some cases compromise with the configuration of the existing facility design may be required.

### 1.3 Deviations from Standard

It is expected that there will be occasional situations where there will be a deviation from this design standard. The rationale for potential deviations from the design standard may include:

- Change in colour scheme classification,
- Addition of new processes,
- Updates to standards and regulations,
- Specific operations requirements.

For any deviation from this standard, complete a *WSTP Standards Deviation Form* and submit to the City project manager for approval. Do not proceed with the proposed deviation unless approval is received from the City project manager.

## 2 PAINT COLOUR CODES-PIPING

1. All piping and specified equipment within the North End Sewage Treatment Plant shall match the below Sherwin Williams paint codes and colour types.
2. Paint products shall be low VOC (Volatile Organic Compound) or water based wherever possible.
3. In the event pipe material prevents it from being painted, coloured bands shall be used.

4. Directional arrows to be used to indicate flow

Item	New Colour Name	Sherwin Williams Paint Code
Centrate	Lemon Chiffon	SW 6686
Chlorine	Solar Yellow	SW 4075
Digester Gas	Safety Red	SW 4081
Dry Polymer Storage	Lime Granita	SW 6715
Ferric Chloride	Solar Yellow	SW 4075
Final/Secondary Effluent	Emerald Ice	SW 4069
Flushing Water	Safety Blue	SW 4086
Glycol Supply	Gala Pink	SW 6579
Glycol Return	Hibiscus	SW 6851
Hot Water Supply	Lucky Green	SW 6926
Hot Water Return	Picnic	SW 6731
Instrument Air	Shamrock (dark green)	SW 6454
Liquid Polymer Storage	Lime Rickey	SW 6717
Mixed Liquor	Extra White	SW 7006
Natural Gas	Safety Yellow	SW 4084
Oxygen	Mature Grape	SW 6286
Potable Water	Vapor (light blue)	MC-85
Primary Effluent	Lazy Grey	SW 6254
Primary Sludge	Iron Ore	SW 7069
Process Air	Grandview (bluer green)	SW 6466
Process Drain	Extra White	SW 7006
Rain Water Leader	Web Gray	SW 7075
Return Activated Sludge- Train 1	Pineapple Cream	SW 1668
Return Activated Sludge- Train 2	Invigorate (orange)	SW 6886
Return Activated Sludge- Train 3	Drift of Mist (Cream)	SW 9166
Sanitary Sewer	Web Gray	SW 7075
Scum/Degreasing	Grays Harbour	SW 6236
Sludge Cake Hopper	Extra White	SW 7006
Sludge Cake Line	Overjoy	SW 6689
Sludge Cake Pump Drive	Festival Green (very green)	SW 6923
Sludge Cake Storage	Overjoy	SW 6689
Sludge Feed/Transfer	Curry	SW 6671
Sludge Mixing System	Navel (kind of pumpkinish)	SW 6887
Thin Sludge	Solaria	SW 6688
Waste Activated Sludge	Tricorn Black	SW 6258
Well Water Supply	Flyway	SW 6794
Well Water Return	Sky Fall	SW 9049

### 3 PAINT COLOUR CODES- EQUIPMENT

1. Paint type should be selected as appropriate for the area in which it will be used. Environmental conditions of the area should be taken into consideration.

Item	New Colour Name	Sherwin Williams Paint Code
Boilers	Heat Resistant Aluminum	B 59S3
Mix Age Polymer Tanks	Outgoing Orange	SW 6641
Motor Bases	Poppy Flower	SW 2904
Polymer Feed Tanks	Techno Teal	SW 4065
Valve Hand/Chain wheels	Safety Red	SW 4081

### 4 PAINT COLOUR CODES- CIVIL STRUCTURE

1. Paint type should be selected as appropriate for the area in which it will be used. Environmental conditions of the area should be taken into consideration.

Item	New Colour Name	Sherwin Williams Paint Code
Concrete/Block work	Cirrus White	SW 4012

### 5 PAINT COLOUR CODES- DUCT

1. Paint type should be selected as appropriate for the area in which it will be used. Environmental conditions of the area should be taken into consideration.
2. Directional arrows to be used to indicate flow.

Item	New Colour Name	Sherwin Williams Paint Code
Duct Work	Unusual Gray	SW 7059

### 6 PAINT COLOUR CODES- OTHER MISCELLANEOUS

1. Paint type should be selected as appropriate for the area in which it will be used. Environmental conditions of the area should be taken into consideration.

Item	New Colour Name	Sherwin Williams Paint Code
Exterior Pedestals/Panels	Safety Yellow	SW 4084
Handrails (Painted)	Aluminum	B 59S2
Bollards	Safety Yellow	SW 4084
Rain Water Leaders	Web Gray	SW 7075
Steel Pipe Supports	Grey	Ansi 61 Grey

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**APPENDIX S - CITY OF WINNIPEG PERMIT FORMS**



## ENTRY PERMIT FOR CONFINED SPACES

**NOTE: THIS FORM MUST BE COMPLETED BEFORE ANYONE IS PERMITTED ENTRY TO A CONFINED AREA.**

1. DATE OF INSPECTION \_\_\_\_\_ 2. TIME VALID FOR \_\_\_\_\_
3. LOCATION \_\_\_\_\_
4. PERSON(S) ENTERING CONFINED AREA \_\_\_\_\_
5. REASON FOR ENTRY \_\_\_\_\_
6. BARRICADE IN PLACE \_\_\_\_\_
7. LOTO IN PLACE IF REQUIRED      YES     NO       NA
8. AREA TESTED FOR EXPLOSIVE GASES BEFORE COVER REMOVED?    YES                   NO
9. AREA RETESTED AFTER COVER REMOVED?    YES     NO     RESULTS \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_
10. AREA TESTED FOR EXPLOSIVE GASES?    YES     NO     RESULTS \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_
11. AREA TESTED FOR OXYGEN?      YES     NO       RESULTS \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_
12. AREA TESTED FOR CARBON MONOXIDE    YES     NO     RESULTS \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_
13. AREA TESTED FOR HYDROGEN SULFIDE?    YES     NO     RESULTS \_\_\_\_\_ / \_\_\_\_\_ / \_\_\_\_\_
14. SAFETY HARNESS CHECKED AND WORN?    YES     NO     PASS/FAIL \_\_\_\_\_  
See Appendix I - Over
15. SAFETY LINES CHECKED AND ATTACHED?    YES     NO     PASS/FAIL \_\_\_\_\_
16. WINCH/HOIST CHECKED AND IN PLACE?    YES     NO     PASS/FAIL \_\_\_\_\_
17. SAFE WORK PROCEDURE REVIEWED AND ONSITE    YES     NO     IF NO, WHY \_\_\_\_\_
18. EMERGENCY STANDBY AND EQUIPMENT IN PLACE    YES     NO     IF NO, WHY \_\_\_\_\_
19. BREATHING APPARATUS CHECKED AND READY FOR USE?    YES     NO     RESULTS \_\_\_\_\_
20. IS BREATHING APPARATUS BEING WORN?    YES     NO     TYPE \_\_\_\_\_
21. IS AREA BEING FORCE VENTILATED?      YES     NO       IF NO, WHY \_\_\_\_\_
22. CONSTANT AIR MONITOR CHECKED?    YES     NO       MONITOR BEING WORN?    YES     NO
23. FIRST AID KIT CHECKED?      YES     NO       RESULTS \_\_\_\_\_
24. IS AREA SAFE FOR ENTRY?      YES     NO       IF NO, CORRECTIVE ACTION TAKEN \_\_\_\_\_

TEST CONDUCTED BY: \_\_\_\_\_

INITIALS OF PERSON (S) ENTERING CONFINED AREA \_\_\_\_\_

DOCUMENT AND REVIEW RESCUE PLAN WITH ALL EMPLOYEES INVOLVED IN ENTRY:

---

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---

HAS A RESCUE PRACTICE BEEN COMPLETED? YES  NO

## 7 Point Harness Inspection - Appendix I

### Visual and Touch Inspection

<b>Stitching</b>	Pulled, cut or missing stitches
<b>Buckles</b>	Broken/distorted, Cracks or breaks, Rust or corrosion,
<b>D-ring - back</b>	Broken/distorted, Cracks or breaks, Rust or corrosion
<b>D-ring - front</b>	Broken/distorted, Cracks or breaks, Rust or corrosion
<b>Leg strap</b>	Cuts, nicks or tears, broken fibers/cracks, fraying, abrasion, marked w/permanent marker, undue stretching, Modification by users (i.e., additional holes), Broken/distorted, missing grommets
<b>Shoulder strap</b>	Cuts, nicks or tears, broken fibers/cracks, fraying, abrasion, undue stretching, marked w/permanent marker
<b>Keepers</b>	Broken/distorted, Cracks or breaks







## Hot Work Permit

<b>Project:</b>
<b>Building:</b>

<b>Staff Member or Contractor Performing the Work</b>	Date
WO #	Contract Administrator

<b>Scope of Work</b>
<b>Specific Work Location</b>
<b>Work Date &amp; Times (Permit valid for duration of work only)</b>

*Permit must be re-issued if any working conditions change (ie: change of shift, new hazard identified, etc.)*

### Emergency Response Procedures

**Emergency Phone Number – 911**      Nearest hospital: \_\_\_\_\_

Identify first aiders: \_\_\_\_\_

Fire extinguisher on site:  Yes      Location: \_\_\_\_\_

Emergency Contacts: \_\_\_\_\_

### Hazard identification (check all). If applicable, identify hazard reduction strategy.

Fumes/Smoke \_\_\_\_\_

Protect Adjacent Surfaces \_\_\_\_\_

Fire Alarm Shutdown    yes     no

Electrical Coordination: \_\_\_\_\_

Fire Watch      yes     no     Conducted by: \_\_\_\_\_

Combustibles/Flammable products within hot zone \_\_\_\_\_

Electrical Hazards      yes     no     \_\_\_\_\_

Asbestos      yes     no     \_\_\_\_\_

Working at heights      yes     no     \_\_\_\_\_

Protect Public and Other Workers \_\_\_\_\_

Other: \_\_\_\_\_

**Prior to Start of Work:**

- 1) Fax permit to Contract Administrator by noon on the day before the work
- 2) City staff: Fax permit to your Supervisor
- 3) Original permit must be posted at the work area for the duration of the work.

**Emergency Repairs:**

- 1) Permit is filled out on site and posted in work area.
- 2) Fax permit to Safety Branch when work is complete (986-3860).

**After work is complete:** Forward original permit to the Contract Administrator (City staff, forward to your Supervisor)

### Final Review Before Starting Work (check all) - Contractors and City Staff

- Scope of work discussed.
- Contractor's person in charge has been identified.
- Adequate ventilation is implemented
- All hazards identified and appropriate safe work procedures implemented.
- PPE selected to mitigate the hazard(s).
- All required safety gear in on-site.
- All required tools and equipment on-site
- All required documentation is on-site (Permit, safe work procedure, MSDS, manuals, prints etc)

### Contractors

Contractors are responsible for their own personal protection equipment, staff training, ventilation, tools and equipment and protecting existing property, other workers, building staff and the general public from any hazards related to the Work. Contractors must fill out the permit, perform the work and send completed copies to the Contract Administrator,

### Project Contacts (please print)

Contract administrator: \_\_\_\_\_ Phone #: \_\_\_\_\_

Contractor site supervisor: \_\_\_\_\_ Phone #: \_\_\_\_\_

### Sign-off

Contractor's person in charge is satisfied all safe-work conditions have been met.

Name: \_\_\_\_\_

Signature: \_\_\_\_\_



**APPENDIX T - CITY OF WINNIPEG QA FORMS**



---

**Form 100**  
**CERTIFICATE OF EQUIPMENT DELIVERY**

---

We certify that the equipment listed below has been delivered into the care and custody of the Installation Contractor. The equipment has been found to be in satisfactory condition. There is no visible evidence of exterior damage or defects.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

---

(Authorized Representative of Supply Contractor)

---

Date

---

(Authorized Representative of Install Contractor)

---

Date

---

(Authorized Representative of Contract Administrator)

---

Date



Water and Waste Department • Service des eaux et des déchets

---

**Form 101**  
**CERTIFICATE OF READINESS TO INSTALL**

---

We have familiarized the installing contractor of the specific requirements related to the equipment listed below and am satisfied that the installing contractor understands the required installation procedures.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

---

(Authorized Representative of Supply Contractor)

---

Date

We certify that we have received satisfactory installation instructions from the equipment manufacturer/vendor.

---

(Authorized Representative of Install Contractor)

---

Date



**Form 102**  
**CERTIFICATE OF SATISFACTORY INSTALLATION**

---

We have completed our checks and inspection of the installation of our equipment as listed below and confirm that it is satisfactory and that any defects have been remedied except any as noted below.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

**Outstanding Defects:**

\_\_\_\_\_  
(Authorized Representative of Supply Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Install Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized Representative of Contractor Administrator)

\_\_\_\_\_  
Date



---

**Form 103**

**CERTIFICATE OF EQUIPMENT SATISFACTORY PERFORMANCE**

---

We certify that the equipment listed below has been continuously operated for a minimum of three (3) consecutive days and that the equipment operates satisfactorily and meets it's specified operating criteria. No defects in the equipment were found and as such are classified as "conforming".

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

\_\_\_\_\_  
(Authorized representative of Supply Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized representative of Install Contractor)

\_\_\_\_\_  
Date

\_\_\_\_\_  
(Authorized representative of Contract Administrator)

\_\_\_\_\_  
Date



---

**Form 104**

**CERTIFICATE OF SATISFACTORY PROCESS PERFORMANCE**

---

We certify that the process system listed below has been continuously operated and tested as per the Specifications using process fluid and that the equipment meets its Performance Testing and Operating Criteria. No defects in the process system were found and as such are classified as “conforming”.

**Project:**

**Equipment Description:**

**Equipment Supply Bid Opp. No.:**

**Equipment Install Bid Opp. No.:**

**Equipment Tag No.:**

**Specification Reference:**

---

(Authorized Representative of Supply Contractor)

---

Date

---

(Authorized Representative of Install Contractor)

---

Date

---

(Authorized Representative of Contract Administrator  
i.e. Commissioning Lead or Design Discipline Lead)

---

Date

---

(Authorized Representative of City)

---

Date

**APPENDIX U - RAS GALLERY 3D MODEL USER GUIDE**

# Memorandum

---

<b>To:</b>	Brian Station, P.Eng.	<b>Date:</b>	September 16, 2021
		<b>Project No.:</b>	21-0107-001
<b>From:</b>	Jason Smith, P.Eng. Andrew Fustey, EIT	<b>Cc:</b>	Adam Pawlikewich, P.Eng. Prasan Silva, P.Eng.
<b>Re:</b>	NEWPCC - RAS Gallery 3-D Model User Guide		

---

## 1.0 INTRODUCTION

The purpose of this document is to serve as a guide for the use of the NEWPCC RAS gallery 3-D model. The model is in the form of a Navisworks *.nwd* file, therefore it may be opened with Autodesk Navisworks Freedom (freely available software application). The model is intended to be used as a visualization tool in conjunction with the associated drawings and documents for the Non-Metallic Composite Repair System for NEWPCC RAS Piping System Refurbishment.

The model contains RAS trains 1, 2, 3, and WAS piping to be refurbished or replaced under the scope of the current project, with all associated manual and automated valves, flowmeters and couplings. It also contains all existing pipe supports and new permanent pipe supports to be constructed, items in proximity to the RAS piping, locations of existing pipe leaks and repairs, and extents of the composite wrap repair system with associated termination sleeves. A colour scheme has been applied to the model to facilitate identification of components. Additionally, the use of the “Sets” function within Navisworks Selection Tree has been used to organize the model and identify the various sub-components contained therein.

## 2.0 COLOUR LEGEND

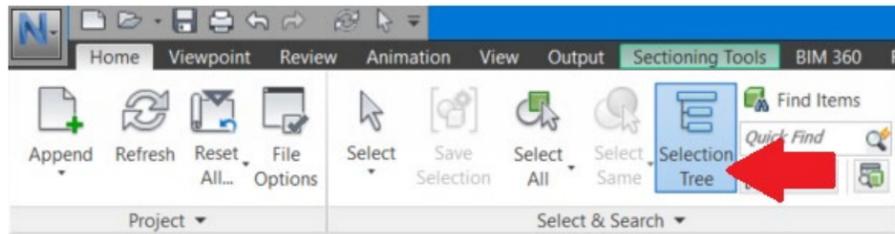
A colour legend has been applied to the model in order to quickly identify different items and sections of piping. The below table outlines the colour scheme of the model.

**TABLE 1: COLOUR LEGEND**

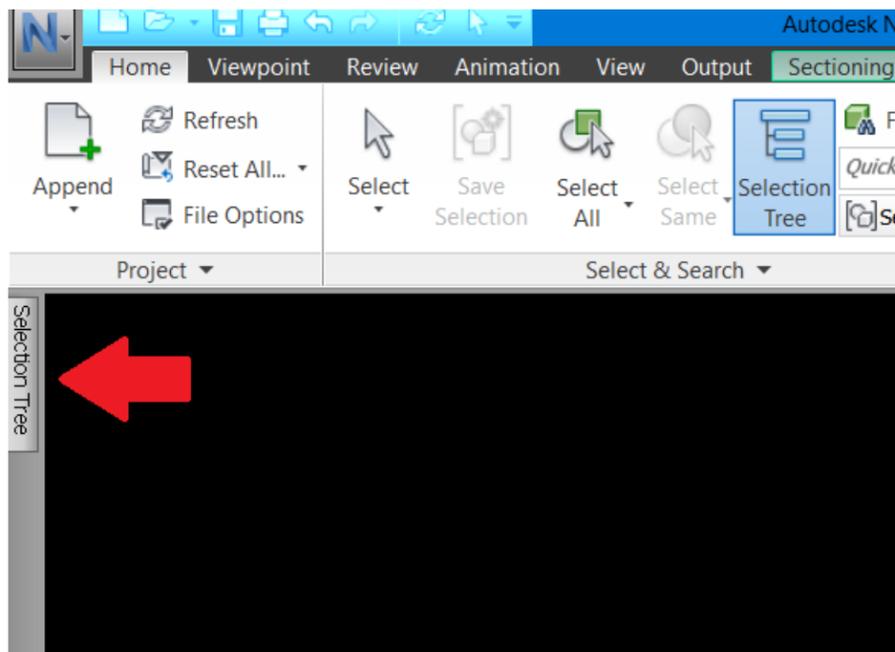
Colour	Image	Description
Beige		RAS 1 Header
Orange		RAS 2 Header
Yellow		RAS 3 Header
Brown		WAS piping
Green		Piping and valves to be replaced, and sleeves for composite wrap termination
Magenta		Instruments and Automated Valves
Cyan		Existing piping supports
Blue		Future permanent piping supports
Grey		Building Structure and Platforms
Red		Proximity piping

### 3.0 NAVISWORKS SELECTION TREE SETS

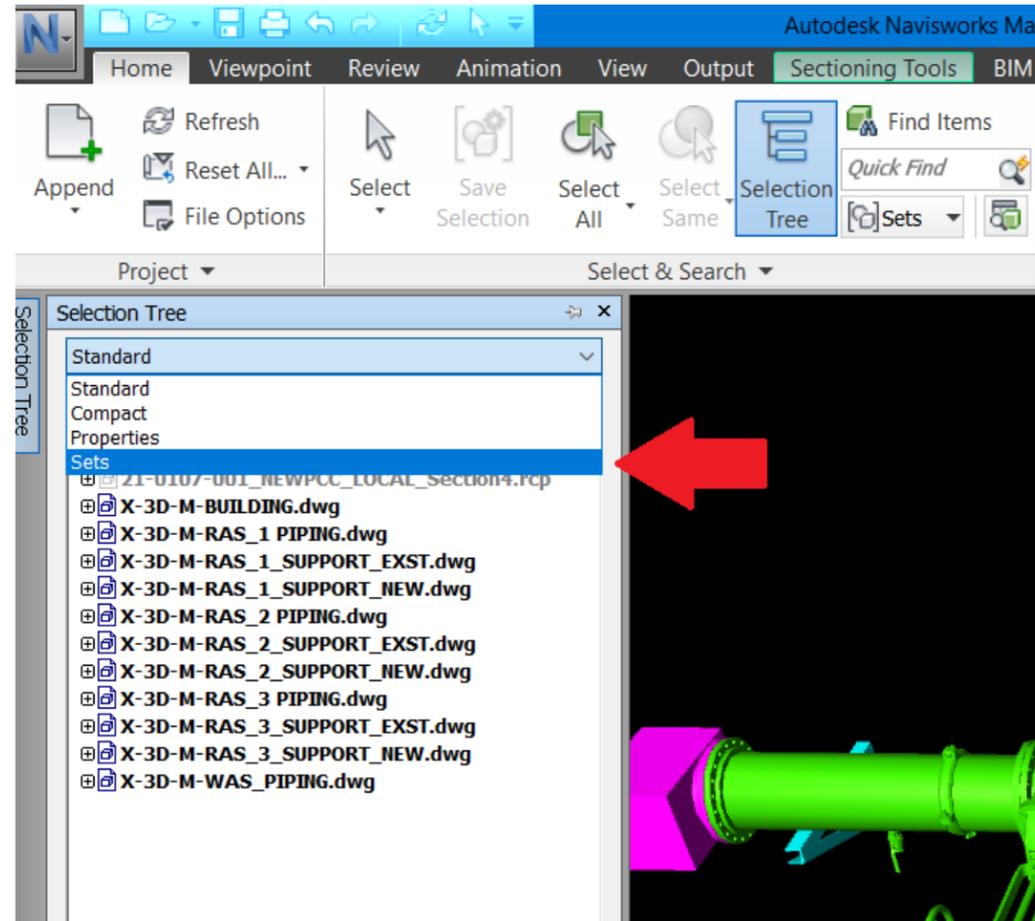
The Navisworks Sets function has been employed to effectively organize the model within the Selection Tree. The following are a list of steps to navigate to the Sets menu:



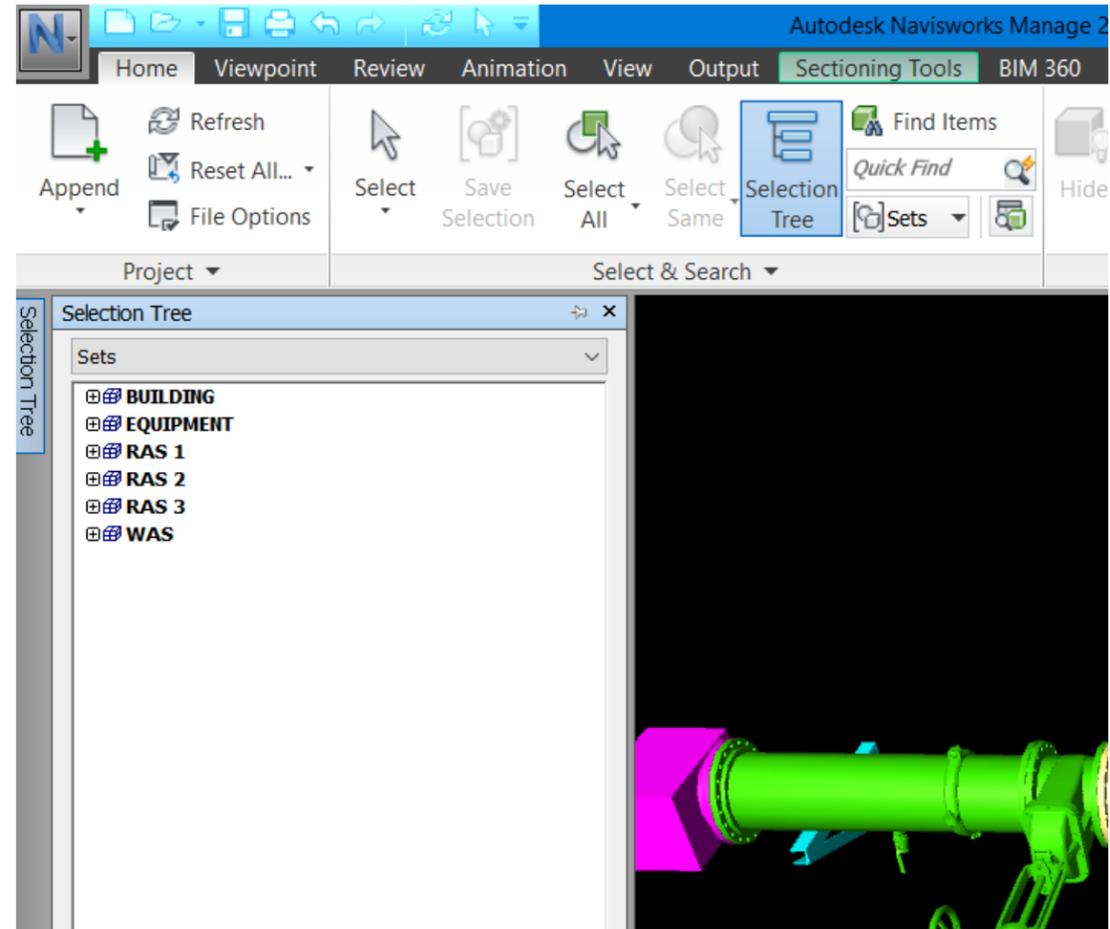
1. Click "Selection Tree" on the "Select and Search" panel of the Home Ribbon.



2. Click the Selection Tree tab on the left-hand side of the screen to open the Selection Tree.



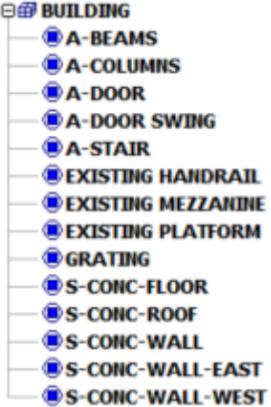
3. Once the Selection Tree panel has opened, use the drop-down menu located at the top of the panel, to navigate to the Sets organization tree.



4. The Sets organization is now open and can be used to find specific items or groups of items within the model.
  - a. Right-clicking on an item either in the Selection Tree, or in the model, enables a menu allowing the item to be hidden or unhidden.
  - b. When an item is selected in the Selection Tree, it will highlight in the model. Using "Zoom Selected" in the Navigation Bar will zoom to the selected item in the model.

The model has been organized into the main categories of BUILDING, EQUIPMENT, RAS 1, RAS 2, RAS 3, WAS, MISC. and REPAIR WRAP SCOPE. The following are a breakdown of the sub categories and their descriptions within each of the main category. These category breakdowns are an example and may not include all items found within the Sets of the model.

**TABLE 2: SETS ORGANIZATION BREAKDOWN**

Category Name	Category Breakdown	Description
<b>BUILDING</b>		
BUILDING	 <pre> graph TD     BUILDING --&gt; A-BEAMS     BUILDING --&gt; A-COLUMNS     BUILDING --&gt; A-DOOR     BUILDING --&gt; A-DOOR_SWING[A-DOOR SWING]     BUILDING --&gt; A-STAIR     BUILDING --&gt; EXISTING_HANDRAIL[EXISTING HANDRAIL]     BUILDING --&gt; EXISTING_MEZZANINE[EXISTING MEZZANINE]     BUILDING --&gt; EXISTING_PLATFORM[EXISTING PLATFORM]     BUILDING --&gt; GRATING     BUILDING --&gt; S-CONC-FLOOR     BUILDING --&gt; S-CONC-ROOF     BUILDING --&gt; S-CONC-WALL     BUILDING --&gt; S-CONC-WALL-EAST     BUILDING --&gt; S-CONC-WALL-WEST             </pre>	Items related to building structure including: floor, walls, roof, concrete columns, walkways, handrails, etc.

	<b>EQUIPMENT</b>	
EQUIPMENT	<ul style="list-style-type: none"> <li>[-] [E] EQUIPMENT               <ul style="list-style-type: none"> <li>[-] [E] INTERCOMS                   <ul style="list-style-type: none"> <li>[+] M-EQIP-INTERCOM EXST</li> <li>[+] M-EQIP-INTERCOM NEW</li> </ul> </li> <li>[-] [E] CABLE TRAYS                   <ul style="list-style-type: none"> <li>[+] M-EQIP-CBL SUPRT</li> <li>[+] M-EQIP-CBL SUPRT NEW</li> <li>[+] M-EQIP-CBL TRAY</li> </ul> </li> <li>[-] [E] POWER EQUIPMENT                   <ul style="list-style-type: none"> <li>[+] E-CONDUIT</li> <li>[+] E-PLATE</li> <li>[+] E-POWER-EQUIPMENT</li> <li>[+] E-POWER-EQUIPMENT-WAS_S942</li> <li>[+] E-POWER-EQUIPMENT-WAS_S943</li> <li>[+] E-SUPPORT</li> <li>[+] E-UNISTRUT</li> </ul> </li> <li>[-] [E] PUMPS                   <ul style="list-style-type: none"> <li>[+] M-EQIP-PUMP</li> <li>[+] M-EQIP-S951-WAP1</li> <li>[+] M-EQIP-S952-WAP2</li> <li>[+] M-EQIP-S953-WAP3</li> <li>[+] M-EQIP-S954-WAP4</li> </ul> </li> </ul> </li> </ul>	Items related to mechanical equipment including pumps, tanks, etc.

<h1>RAS 1</h1>		
RAS 1	<ul style="list-style-type: none"> <li>[-] RAS 1                     <ul style="list-style-type: none"> <li>[-] PIPING                             <ul style="list-style-type: none"> <li>● M-PIPE-RAS 1_100</li> <li>● M-PIPE-RAS 1_300</li> <li>● M-PIPE-RAS 1_450</li> <li>● M-PIPE-RAS 1_500</li> <li>● M-PIPE-RAS 1_500_REPLACEMENT</li> <li>● M-PIPE-RAS 1_600</li> <li>● M-PIPE-RAS 1_750</li> <li>● M-PIPE-RAS 1_900</li> </ul> </li> <li>[-] VALVES - AUTO                             <ul style="list-style-type: none"> <li>● M-VALVE-AUTO-R810-BV-1A</li> <li>● M-VALVE-AUTO-R815-BV-1B</li> </ul> </li> <li>[-] VALVES - MANUAL                             <ul style="list-style-type: none"> <li>● M-VALVE-MANUAL-R810-KV-1A</li> <li>● M-VALVE-MANUAL-R815-KV-1B</li> <li>● M-VALVE-MANUAL-S801-HV</li> <li>● M-VALVE-MANUAL-S801-HV-2</li> <li>● M-VALVE-MANUAL-S901-HV4-1</li> <li>● M-VALVE-MANUAL-S902-HV4-2</li> <li>● M-VALVE-MANUAL-S903-HV4-3</li> <li>● M-VALVE-MANUAL-S904-HV4-4</li> <li>● M-VALVE-MANUAL-S905-HV4-5</li> <li>● M-VALVE-MANUAL-S906-HV4-6</li> <li>● M-VALVE-MANUAL-S907-HV2-7</li> <li>● M-VALVE-MANUAL-S908-HV4-8</li> <li>● M-VALVE-MANUAL-S909-HV4-9</li> <li>● M-VALVE-MANUAL-S910-HV4-10</li> <li>● M-VALVE-MANUAL-HPV-1.01</li> <li>● M-VALVE-MANUAL-HPV-1.02</li> <li>● M-VALVE-MANUAL-HPV-1.03</li> <li>● M-VALVE-MANUAL-LPD-1.01</li> <li>● M-VALVE-MANUAL-LPD-1.02</li> <li>● M-VALVE-MANUAL-LPD-1.03</li> <li>● M-VALVE-MANUAL-LPD-1.04</li> </ul> </li> <li>[-] COUPLINGS                             <ul style="list-style-type: none"> <li>● M-COUPLING-CPLG-1.01</li> <li>● M-COUPLING-CPLG-1.02</li> <li>● M-COUPLING-CPLG-1.03</li> <li>● M-COUPLING-CPLG-1.04</li> </ul> </li> <li>[-] FLOW METERS                             <ul style="list-style-type: none"> <li>● M-FLOWMETER-R810-FE</li> <li>● M-FLOWMETER-R815-FE</li> </ul> </li> <li>[-] SUPPORTS - EXISTING</li> </ul> </li> </ul>	<p>Items related to the RAS 1 Header including valves, couplings, piping, flow meters, supports and CFRP termination sleeves.</p>

# RAS 1

## WALL BRACKETS

- PSE-1.02.01
- PSE-1.02.02
- PSE-1.02.03
- PSE-1.02.04
- PSE-1.02.05
- PSE-1.02.06
- PSE-1.02.07
- PSE-1.02.08
- PSE-1.02.09
- PSE-1.02.10
- PSE-1.02.11
- PSE-1.02.12

## CONCRETE SADDLES

- PSE-1.03.01
- PSE-1.03.02
- PSE-1.03.03
- PSE-1.03.04

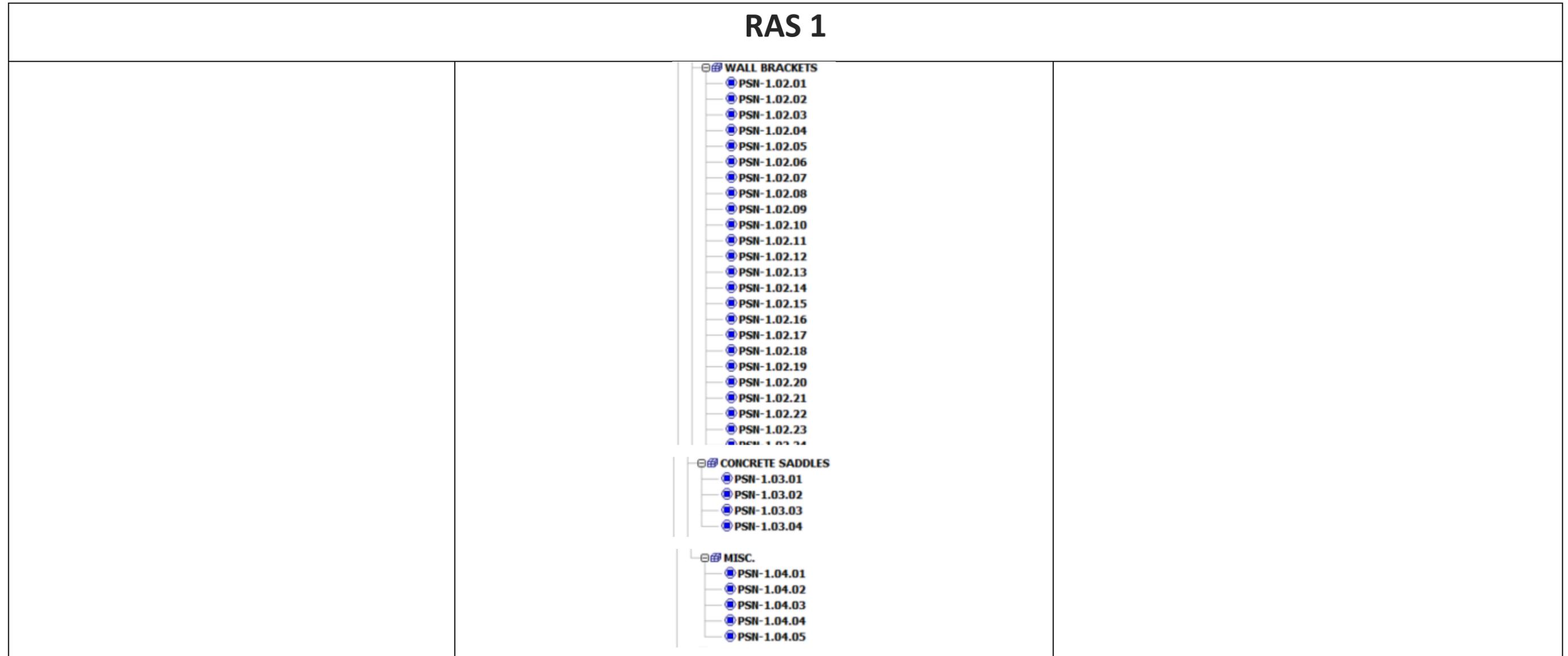
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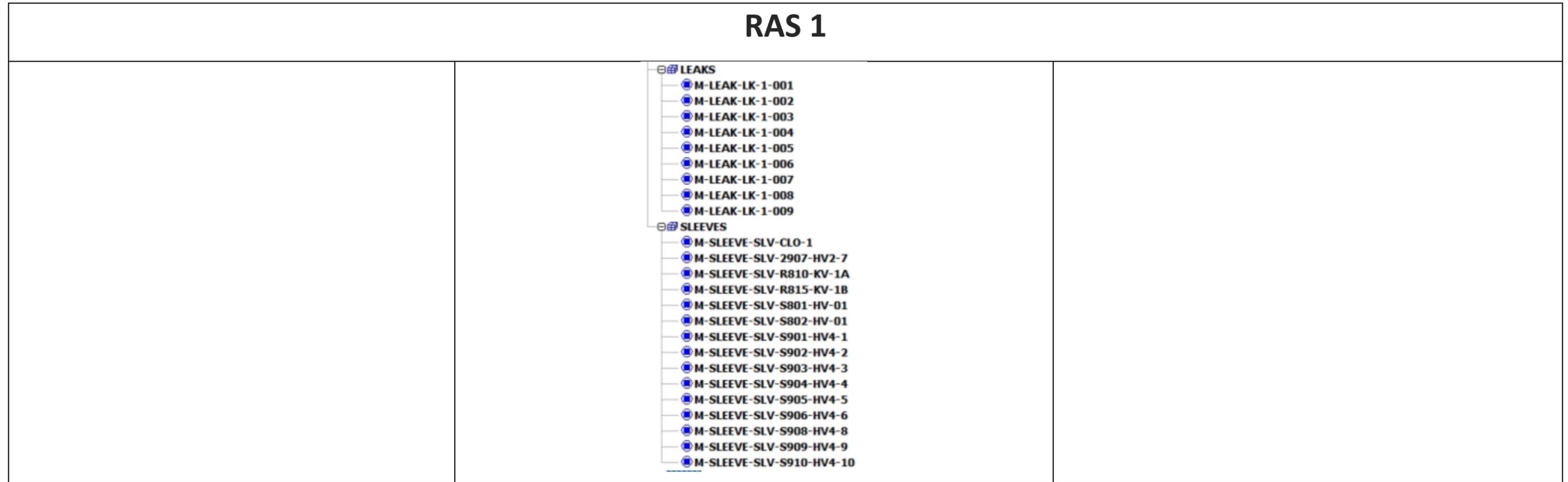
- PSE-1.04.01
- PSE-1.04.02
- PSE-1.04.03
- PSE-1.04.04
- PSE-1.04.05
- PSE-1.04.06
- PSE-1.04.07
- PSE-1.04.08
- PSE-1.04.09
- PSE-1.04.10
- PSE-1.04.11
- PSE-1.04.12
- PSE-1.04.13
- PSE-1.04.14
- PSE-1.04.15
- PSE-1.04.16

## SUPPORTS - NEW

### POSTS

- PSN-1.01.01
- PSN-1.01.02
- PSN-1.01.03
- PSN-1.01.04
- PSN-1.01.05
- PSN-1.01.06
- PSN-1.01.07
- PSN-1.01.08



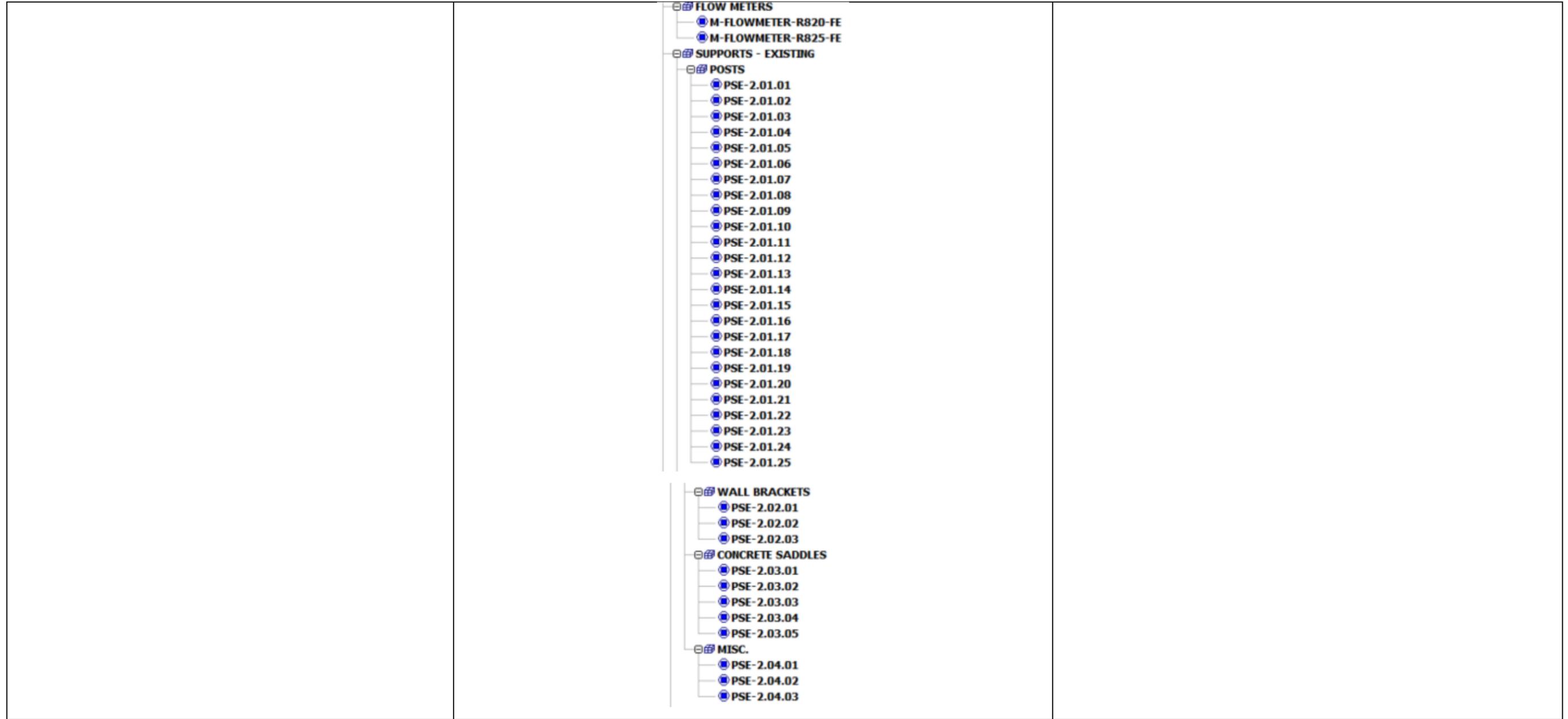


# RAS 2

RAS 2

- [-] RAS 2
  - [-] PIPING
    - M-PIPE-RAS 2\_100
    - M-PIPE-RAS 2\_300
    - M-PIPE-RAS 2\_450
    - M-PIPE-RAS 2\_500
    - M-PIPE-RAS 2\_500 REPLACEMENT
    - M-PIPE-RAS 2\_600
    - M-PIPE-RAS 2\_750
    - M-PIPE-RAS 2\_900
  - [-] VALVES - AUTO
    - M-VALVE-AUTO-R820-BV-2A
    - M-VALVE-AUTO-R825-BV-2B
  - [-] VALVES - MANUAL
    - M-VALVE-MANUAL-HPV-2.01
    - M-VALVE-MANUAL-HPV-2.02
    - M-VALVE-MANUAL-LPD-2.01
    - M-VALVE-MANUAL-LPD-2.02
    - M-VALVE-MANUAL-LPD-2.03
    - M-VALVE-MANUAL-R820-KV-2A
    - M-VALVE-MANUAL-R825-KV-2B
    - M-VALVE-MANUAL-S802-HV
    - M-VALVE-MANUAL-S802-HV-2
    - M-VALVE-MANUAL-S911-HV-11.12
    - M-VALVE-MANUAL-S911-HV1-11
    - M-VALVE-MANUAL-S911-HV4-11
    - M-VALVE-MANUAL-S912-HV1-12
    - M-VALVE-MANUAL-S912-HV4-12
    - M-VALVE-MANUAL-S913-HV-13.14
    - M-VALVE-MANUAL-S913-HV1-13
    - M-VALVE-MANUAL-S913-HV4-13
    - M-VALVE-MANUAL-S914-HV1-14
    - M-VALVE-MANUAL-S914-HV4-14
    - M-VALVE-MANUAL-S915-HV-15.16
    - M-VALVE-MANUAL-S915-HV1-15
    - M-VALVE-MANUAL-S915-HV4-15
    - M-VALVE-MANUAL-S916-HV1-16
    - M-VALVE-MANUAL-S916-HV4-16
    - M-VALVE-MANUAL-S917-HV-17.18
    - M-VALVE-MANUAL-S917-HV1-17
    - M-VALVE-MANUAL-S917-HV4-17
    - M-VALVE-MANUAL-S918-HV1-18
    - M-VALVE-MANUAL-S918-HV4-18
  - [-] COUPLINGS
    - M-COUPPING-CPLG-2.01
    - M-COUPPING-CPLG-2.02
    - M-COUPPING-CPLG-2.03

Items related to the RAS 2 Header including, valves, couplings, piping, flow meters, supports and CFRP termination sleeves.



		<ul style="list-style-type: none"><li>[-] SUPPORTS - NEW<ul style="list-style-type: none"><li>[-] STEEL PEDESTAL<ul style="list-style-type: none"><li>PSN-2.05.01</li><li>PSN-2.05.02</li><li>PSN-2.05.03</li><li>PSN-2.05.04</li><li>PSN-2.05.05</li><li>PSN-2.05.06</li></ul></li><li>[-] POSTS<ul style="list-style-type: none"><li>PSN-2.01.01</li><li>PSN-2.01.02</li><li>PSN-2.01.03</li><li>PSN-2.01.04</li><li>PSN-2.01.05</li><li>PSN-2.01.06</li><li>PSN-2.01.07</li><li>PSN-2.01.08</li><li>PSN-2.01.09</li><li>PSN-2.01.10</li><li>PSN-2.01.11</li><li>PSN-2.01.12</li><li>PSN-2.01.13</li><li>PSN-2.01.14</li><li>PSN-2.01.15</li><li>PSN-2.01.16</li><li>PSN-2.01.17</li><li>PSN-2.01.18</li><li>PSN-2.01.19</li><li>PSN-2.01.20</li><li>PSN-2.01.21</li><li>PSN-2.01.22</li><li>PSN-2.01.23</li><li>PSN-2.01.24</li><li>PSN-2.01.25</li><li>PSN-2.01.26</li></ul></li><li>[-] MISC.<ul style="list-style-type: none"><li>PSN-2.04.01</li></ul></li></ul></li></ul>
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	<ul style="list-style-type: none"><li>LEAKS<ul style="list-style-type: none"><li>M-LEAK-LK-2-001</li><li>M-LEAK-LK-2-002</li><li>M-LEAK-LK-2-003</li><li>M-LEAK-LK-2-004</li><li>M-LEAK-LK-2-005</li><li>M-LEAK-LK-2-006</li></ul></li><li>SLEEVES<ul style="list-style-type: none"><li>M-SLEEVE-SLV-CLO-2</li><li>M-SLEEVE-SLV-CLAR-11</li><li>M-SLEEVE-SLV-CLAR-12</li><li>M-SLEEVE-SLV-CLAR-13</li><li>M-SLEEVE-SLV-CLAR-14</li><li>M-SLEEVE-SLV-CLAR-15</li><li>M-SLEEVE-SLV-CLAR-16</li><li>M-SLEEVE-SLV-CLAR-17</li><li>M-SLEEVE-SLV-CLAR-18</li><li>M-SLEEVE-SLV-R820-KV-2A</li><li>M-SLEEVE-SLV-R825-KV-2B</li><li>M-SLEEVE-SLV-S802-HV-02</li><li>M-SLEEVE-SLV-S803-HV-02</li><li>M-SLEEVE-SLV-S911-HV1-11</li><li>M-SLEEVE-SLV-S911-HV4-11</li><li>M-SLEEVE-SLV-S912-HV1-12</li><li>M-SLEEVE-SLV-S912-HV4-12</li><li>M-SLEEVE-SLV-S913-HV1-13</li><li>M-SLEEVE-SLV-S913-HV4-13</li><li>M-SLEEVE-SLV-S914-HV1-14</li><li>M-SLEEVE-SLV-S914-HV4-14</li><li>M-SLEEVE-SLV-S915-HV1-15</li><li>M-SLEEVE-SLV-S915-HV4-15</li><li>M-SLEEVE-SLV-S916-HV1-16</li><li>M-SLEEVE-SLV-S916-HV4-16</li><li>M-SLEEVE-SLV-S917-HV1-17</li><li>M-SLEEVE-SLV-S917-HV4-17</li><li>M-SLEEVE-SLV-S918-HV1-18</li><li>M-SLEEVE-SLV-S918-HV4-18</li></ul></li></ul>	
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# RAS 3

RAS 3

- [-] RAS 3
  - [-] PIPING
    - M-PIPE-RAS 3\_100
    - M-PIPE-RAS 3\_300
    - M-PIPE-RAS 3\_450
    - M-PIPE-RAS 3\_500
    - M-PIPE-RAS 3\_500\_REPLACEMENT
    - M-PIPE-RAS 3\_600
    - M-PIPE-RAS 3\_750
    - M-PIPE-RAS 3\_900
  - [-] VALVES - AUTO
    - M-VALVE-AUTO-R830-BV-3A
    - M-VALVE-AUTO-R835-BV-3B
  - [-] VALVES - MANUAL
    - M-VALVE-MANUAL-HPV-3.01
    - M-VALVE-MANUAL-HPV-3.02
    - M-VALVE-MANUAL-HPV-3.03
    - M-VALVE-MANUAL-HPV-3.04
    - M-VALVE-MANUAL-LPD-3.05
    - M-VALVE-MANUAL-LPD-3.01
    - M-VALVE-MANUAL-LPD-3.02
    - M-VALVE-MANUAL-LPD-3.03
    - M-VALVE-MANUAL-LPD-3.04
    - M-VALVE-MANUAL-R830-KV-3A
    - M-VALVE-MANUAL-R835-KV-3B
    - M-VALVE-MANUAL-S803-HV
    - M-VALVE-MANUAL-S803-HV-2
    - M-VALVE-MANUAL-S919-HV-19.20
    - M-VALVE-MANUAL-S919-HV1-19
    - M-VALVE-MANUAL-S919-HV4-19
    - M-VALVE-MANUAL-S920-HV1-20
    - M-VALVE-MANUAL-S920-HV4-20
    - M-VALVE-MANUAL-S921-HV-21.22
    - M-VALVE-MANUAL-S921-HV1-21
    - M-VALVE-MANUAL-S921-HV4-21
    - M-VALVE-MANUAL-S922-HV1-22
    - M-VALVE-MANUAL-S922-HV4-22
    - M-VALVE-MANUAL-S923-HV-23.24
    - M-VALVE-MANUAL-S923-HV1-23
    - M-VALVE-MANUAL-S923-HV4-23
    - M-VALVE-MANUAL-S924-HV1-24
    - M-VALVE-MANUAL-S924-HV4-24
    - M-VALVE-MANUAL-S925-HV-25.26
    - M-VALVE-MANUAL-S925-HV1-25
    - M-VALVE-MANUAL-S925-HV4-25
    - M-VALVE-MANUAL-S926-HV1-26
    - M-VALVE-MANUAL-S926-HV4-26

Items related to the RAS 3 Header including, valves, couplings, piping, flow meters, supports and CFRP termination sleeves.

# RAS 3

- [-] COUPLINGS
  - [-] M-COUPLING-CPLG-3.01
  - [-] M-COUPLING-CPLG-3.02
  - [-] M-COUPLING-CPLG-3.03
  - [-] M-COUPLING-CPLG-3.04
  - [-] M-COUPLING-CPLG-3.05
  - [-] M-COUPLING-CPLG-3.06
- [-] FLOW METERS
  - [-] M-FLOWMETER-R830-FE
  - [-] M-FLOWMETER-R835-FE
- [-] SUPPORTS - EXISTING
  - [-] POSTS
    - [-] PSE-3.01.01
    - [-] PSE-3.01.02
    - [-] PSE-3.01.03
    - [-] PSE-3.01.04
    - [-] PSE-3.01.05
    - [-] PSE-3.01.06
    - [-] PSE-3.01.07
    - [-] PSE-3.01.08
    - [-] PSE-3.01.09
    - [-] PSE-3.01.10
    - [-] PSE-3.01.11
    - [-] PSE-3.01.12
    - [-] PSE-3.01.13
    - [-] PSE-3.01.14
    - [-] PSE-3.01.15
    - [-] PSE-3.01.16
    - [-] PSE-3.01.17
    - [-] PSE-3.01.18
    - [-] PSE-3.01.19
    - [-] PSE-3.01.20
    - [-] PSE-3.01.21
    - [-] PSE-3.01.22
    - [-] PSE-3.01.23
    - [-] PSE-3.01.24
    - [-] PSE-3.01.25
    - [-] PSE-3.01.26

# RAS 3

## WALL BRACKETS

- PSE-3.02.01
- PSE-3.02.02
- PSE-3.02.03
- PSE-3.02.04
- PSE-3.02.05
- PSE-3.02.06
- PSE-3.02.07
- PSE-3.02.08
- PSE-3.02.09
- PSE-3.02.10
- PSE-3.02.11
- PSE-3.02.12
- PSE-3.02.13
- PSE-3.02.14
- PSE-3.02.15
- PSE-3.02.16
- PSE-3.02.17
- PSE-3.02.18
- PSE-3.02.19
- PSE-3.02.20
- PSE-3.02.21
- PSE-3.02.22

## CONCRETE SADDLES

- PSE-3.03.01
- PSE-3.03.02
- PSE-3.03.03
- PSE-3.03.04
- PSE-3.03.05
- PSE-3.03.06
- PSE-3.03.07
- PSE-3.03.08
- PSE-3.03.09
- PSE-3.03.10
- PSE-3.03.11
- PSE-3.03.12

## MISC.

- PSE-3.04.01
- PSE-3.04.02
- PSE-3.04.03
- PSE-3.04.04
- PSE-3.04.05
- PSE-3.04.06

# RAS 3

- ☐ SUPPORTS - NEW
- ☐ POSTS
- PSN-3.01.01
- PSN-3.01.02
- PSN-3.01.03
- PSN-3.01.04
- PSN-3.01.05
- PSN-3.01.06
- PSN-3.01.07
- PSN-3.01.08
- PSN-3.01.09
- PSN-3.01.10
- PSN-3.01.11
- PSN-3.01.12
- PSN-3.01.13
- PSN-3.01.14
- PSN-3.01.15
- PSN-3.01.16
- PSN-3.01.17
- PSN-3.01.18
- PSN-3.01.19
- PSN-3.01.20
- PSN-3.01.21
- PSN-3.01.22
- PSN-3.01.23
- PSN-3.01.24
- PSN-3.01.25
- PSN-3.01.26

# RAS 3

## WALL BRACKETS

- PSN-3.02.01
- PSN-3.02.02
- PSN-3.02.03
- PSN-3.02.04
- PSN-3.02.05
- PSN-3.02.06
- PSN-3.02.07
- PSN-3.02.08
- PSN-3.02.09
- PSN-3.02.10
- PSN-3.02.11
- PSN-3.02.12
- PSN-3.02.13
- PSN-3.02.14
- PSN-3.02.15
- PSN-3.02.16
- PSN-3.02.17
- PSN-3.02.18
- PSN-3.02.19
- PSN-3.02.20

## STEEL PEDESTAL

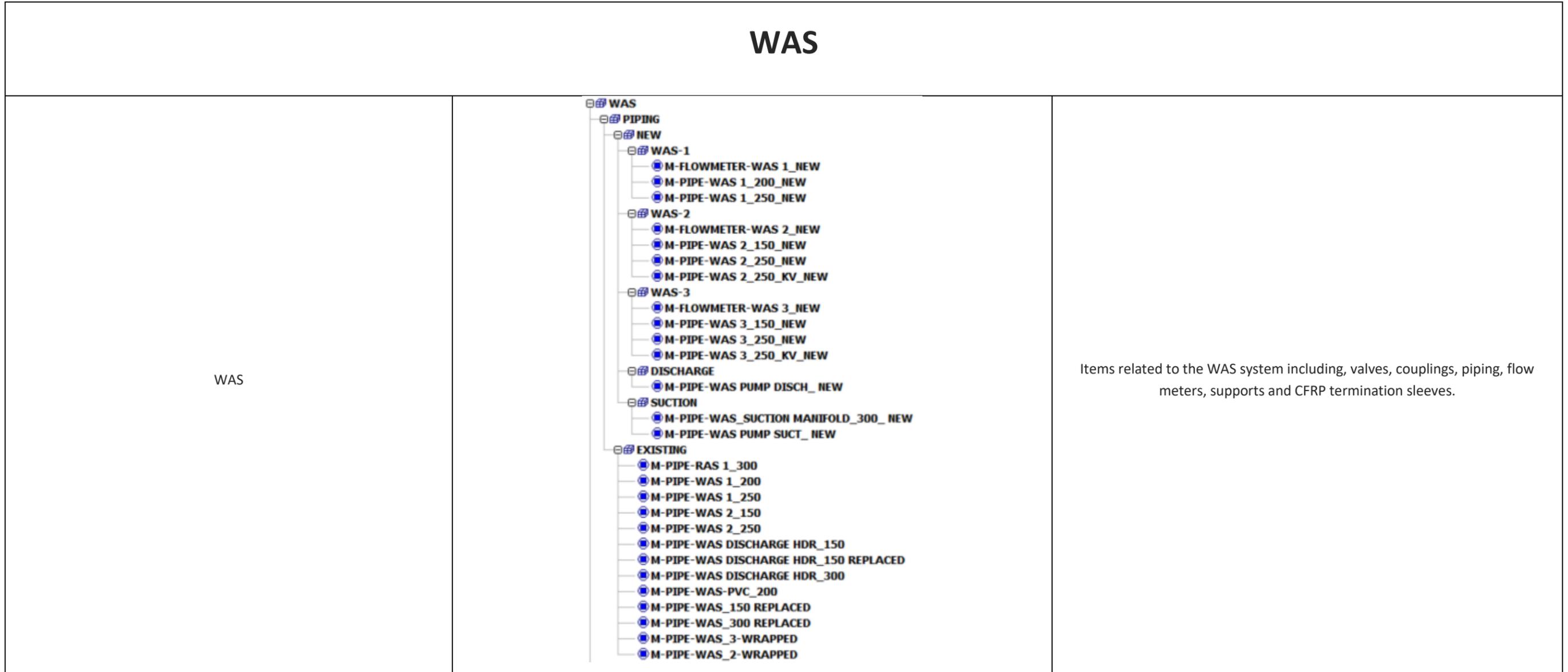
- PSN-3.05.01
- PSN-3.05.02
- PSN-3.05.03
- PSN-3.05.04
- PSN-3.05.05
- PSN-3.05.06
- PSN-3.05.07
- PSN-3.05.08
- PSN-3.05.09
- PSN-3.05.10
- PSN-3.05.11
- PSN-3.05.12

## MISC.

- PSN-3.04.01
- PSN-3.04.02
- PSN-3.04.03
- PSN-3.04.04
- PSN-3.04.05
- PSN-3.04.06
- PSN-3.04.07
- PSN-3.04.08
- PSN-3.04.09

# RAS 3

- LEAKS
  - M-LEAK-LK-3-001
  - M-LEAK-LK-3-002
  - M-LEAK-LK-3-003
  - M-LEAK-LK-3-004
  - M-LEAK-LK-3-005
  - M-LEAK-LK-3-006
  - M-LEAK-LK-3-007
  - M-LEAK-LK-3-008
  - M-LEAK-LK-3-009
  - M-LEAK-LK-3-010
- SLEEVES
  - M-SLEEVE-SLV-CLO-3
  - M-SLEEVE-SLV-CLAR-19
  - M-SLEEVE-SLV-CLAR-20
  - M-SLEEVE-SLV-CLAR-21
  - M-SLEEVE-SLV-CLAR-22
  - M-SLEEVE-SLV-CLAR-23
  - M-SLEEVE-SLV-CLAR-24
  - M-SLEEVE-SLV-CLAR-25
  - M-SLEEVE-SLV-CLAR-26
  - M-SLEEVE-SLV-R830-KV-3A
  - M-SLEEVE-SLV-R835-KV-3B
  - M-SLEEVE-SLV-S801-HV-02
  - M-SLEEVE-SLV-S803-HV-01
  - M-SLEEVE-SLV-S803-HV-02
  - M-SLEEVE-SLV-S919-HV1-19
  - M-SLEEVE-SLV-S919-HV4-19
  - M-SLEEVE-SLV-S920-HV1-20
  - M-SLEEVE-SLV-S920-HV4-20
  - M-SLEEVE-SLV-S921-HV1-21
  - M-SLEEVE-SLV-S921-HV4-21
  - M-SLEEVE-SLV-S922-HV1-22
  - M-SLEEVE-SLV-S922-HV4-22
  - M-SLEEVE-SLV-S923-HV1-23
  - M-SLEEVE-SLV-S923-HV4-23
  - M-SLEEVE-SLV-S924-HV1-24
  - M-SLEEVE-SLV-S924-HV4-24
  - M-SLEEVE-SLV-S925-HV1-25
  - M-SLEEVE-SLV-S925-HV4-25
  - M-SLEEVE-SLV-S926-HV1-26
  - M-SLEEVE-SLV-S926-HV4-26



# WAS

- [-] VALVES - AUTO
  - M-VALVE-AUTO-S941-HV-3
  - M-VALVE-AUTO-S942-HV-2
  - M-VALVE-AUTO-S943-HV-1
- [-] VALVES - MANUAL
  - M-VALVE-MANUAL-KV-1.01 (NEW)
  - M-VALVE-MANUAL-KV-1.02 (NEW)
  - M-VALVE-MANUAL-KV-1.03 (NEW)
  - M-VALVE-MANUAL-S941-HV1-3
  - M-VALVE-MANUAL-S942-HV1-2
  - M-VALVE-MANUAL-S943-HV1-1
  - M-VALVE-MANUAL-S943-HV2-1
  - M-VALVE-MANUAL-S951-HV1-1
  - M-VALVE-MANUAL-S951-HV2-1
  - M-VALVE-MANUAL-S951-HV3-1
  - M-VALVE-MANUAL-S951-HV4-1
  - M-VALVE-MANUAL-S952-HV1-2
  - M-VALVE-MANUAL-S952-HV2-2
  - M-VALVE-MANUAL-S952-HV3-2
  - M-VALVE-MANUAL-S952-HV4-2
  - M-VALVE-MANUAL-S953-HV1-3
  - M-VALVE-MANUAL-S953-HV2-3
  - M-VALVE-MANUAL-S953-HV3-3
  - M-VALVE-MANUAL-S953-HV4-3
  - M-VALVE-MANUAL-S954-HV1-4
  - M-VALVE-MANUAL-S954-HV2-4
  - M-VALVE-MANUAL-S954-HV3-4
  - M-VALVE-MANUAL-S954-HV4-4
- [-] FLOW METERS
  - M-FLOWMETER-S941-FE
  - M-FLOWMETER-S942-FE
  - M-FLOWMETER-S943-FE
  - M-FLOWMETER-S951-AE
  - M-FLOWMETER-S952-AE
  - M-FLOWMETER-S953-AE
  - M-FLOWMETER-S954-AE

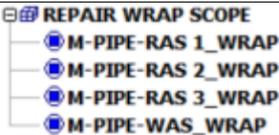
<h1>WAS</h1>			
		<ul style="list-style-type: none"><li>☐ SUPPORTS - EXISTING<ul style="list-style-type: none"><li>● PSE-4.04.01</li><li>● PSE-4.04.02</li><li>● PSE-4.04.03</li><li>● PSE-4.04.04</li><li>● PSE-4.04.06</li><li>● PSE-4.04.07</li><li>● PSE-4.04.08</li><li>● PSE-4.04.09</li><li>● PSE-4.04.10</li><li>● PSE-4.04.11</li><li>● PSE-4.04.12</li><li>● PSE-4.04.13</li><li>● PSE-4.04.14</li><li>● PSE-4.04.15</li><li>● PSE-4.04.16</li><li>● PSE-4.04.17</li><li>● PSE-4.DEMO.05</li><li>● PSE-4.DEMO.18</li><li>● PSE-4.DEMO.19</li><li>● PSE-4.DEMO.20</li><li>● PSE-4.DEMO.21</li><li>● PSE-4.DEMO.22</li></ul></li></ul>	

# WAS

- [-] SUPPORTS - NEW
  - [-] POST
    - PSN-4.01.01
  - [-] MISC.
    - PSN-4.04.01
    - PSN-4.04.02
    - PSN-4.04.03
    - PSN-4.04.04
    - PSN-4.04.05
    - PSN-4.04.06
    - PSN-4.04.07
    - PSN-4.04.08
    - PSN-4.04.09
    - PSN-4.04.10
    - PSN-4.04.11
    - PSN-4.04.12
    - PSN-4.04.13
    - PSN-4.04.14
    - PSN-4.04.15
    - PSN-4.04.16
    - PSN-4.04.17
    - PSN-4.04.18
    - PSN-4.04.19
    - PSN-4.04.20
    - PSN-4.04.21
    - PSN-4.04.22
    - PSN-4.04.23
    - PSN-4.04.24
    - PSN-4.04.25

<h1>WAS</h1>		
	<ul style="list-style-type: none"> <li>WALL BRACKETS</li> <li>PSN-4.02.01</li> <li>PSN-4.02.02</li> <li>PSN-4.02.03</li> <li>PSN-4.02.04</li> <li>PSN-4.02.05</li> <li>PSN-4.02.06</li> <li>PSN-4.02.07</li> <li>PSN-4.02.08</li> <li>PSN-4.02.09</li> <li>PSN-4.02.10</li> <li>PSN-4.02.11</li> <li>PSN-4.02.12</li> <li>PSN-4.02.13</li> <li>PSN-4.02.14</li> <li>PSN-4.02.15</li> <li>PSN-4.02.16</li> <li>PSN-4.02.17</li> <li>PSN-4.02.18</li> <li>PSN-4.02.19</li> <li>PSN-4.02.20</li> <li>PSN-4.02.21</li> <li>PSN-4.02.22</li> <li>PSN-4.02.23</li> <li>PSN-4.02.24</li> </ul> <ul style="list-style-type: none"> <li>SLEEVES</li> <li>M-SLEEVE-SLV-S941-HV-3</li> <li>M-SLEEVE-SLV-S942-HV-2</li> <li>M-SLEEVE-SLV-S943-HV-1</li> <li>M-SLEEVE-SLV-WAS-1</li> <li>M-SLEEVE-SLV-S954-HV4-4</li> <li>M-SLEEVE-SLV-S951-HV4-1</li> </ul>	

<h1>MISC.</h1>		
MISC.	<ul style="list-style-type: none"> <li>MISC.</li> <li>M-PIPE-MISC</li> </ul>	Miscellaneous piping that is in proximity to the scope of work.

REPAIR WRAP SCOPE		
REPAIR WRAP SCOPE	 <ul style="list-style-type: none"><li>REPAIR WRAP SCOPE<ul style="list-style-type: none"><li>M-PIPE-RAS 1_WRAP</li><li>M-PIPE-RAS 2_WRAP</li><li>M-PIPE-RAS 3_WRAP</li><li>M-PIPE-WAS_WRAP</li></ul></li></ul>	Scope of pipe to be wrapped.

## 4.0 CONCLUSION

For questions related to this document, or use of the Navisworks 3D model, please do not hesitate to contact the undersigned.

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AF/pd

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# STATEMENT OF LIMITATIONS AND CONDITIONS

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This memorandum has been prepared for the City of Winnipeg (the City) in accordance with the agreement between KGS Group and the City (the “Agreement”). This memorandum represents KGS Group’s professional judgment and exercising due care consistent with the preparation of similar documents. The information, data, recommendations and conclusions in this memorandum are subject to the constraints and limitations in the Agreement and the qualifications in this memorandum. This memorandum must be read as a whole, and sections or parts should not be read out of context.

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