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AWARDS 2014: WATER RESOURCES

AECOM

DUFFIN CREEK WATER POLLUTION CONTROL PLANT – STAGE III DEWATERING BUILDING

LEED® GOLD Certified NC v1.0 Water Pollution Control Plant

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DURHAM REGION

York Region

75 WORD SUMMARY

SECTION 1

75 WORD SUMMARY

The Regions of York and Durham are facing rapid population growth and development, so they commissioned AECOM to design and construct a state of the art new LEED Dewatering Building. This is the first ever LEED® Gold Certified building of its type in Canada. The expanded plant can process up to 610 million liters per day of wastewater, is one of the larger plants in Canada, and will accommodate the municipalities' future growth.

Aerial of Project 2012

PROJECT HIGHLIGHTS

SECTION 2
PROJECT HIGHLIGHTS

2.1 INNOVATION

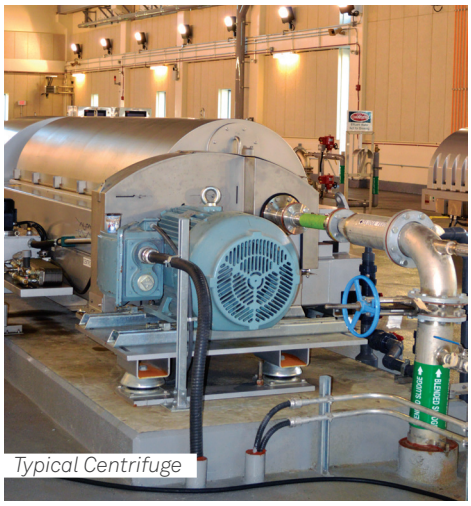
A state of the art biosolids transport system was designed

From the Digester Complex, liquid blended biosolids is pumped to holding tanks located adjacent to the new Dewatering Building, where it is feed to eight high speed horizontal dewatering centrifuges, located on the top floor of the new dewatering complex.

These eight high speed centrifuges produce a dewatered biosolids sludge cake (25 to 30% solids) which is conveyed to one of four (4) storage silos. Each storage silo is equipped with two high pressure biosolids pumps where one biosolids pump is dedicated to one incinerator and the other second biosolids pump is used as 100% standby to the adjacent incinerator. This approach provides each incinerator with a standby high


Hydraulic Pressure Biosolids Piping

Main Entrance


Typical Centrifuge

SECTION 2

PROJECT HIGHLIGHTS CONT'D

pressure biosolids feed pump. The design also provides further redundancy and flexibility by enabling any centrifuge to supply any one of the storage silos via classifying and distribution conveyors located on the lower second floor.

High pressure biosolids pumps, located in the new Dewatering Building basement, inject each of four fluidized bed incinerators, located in the adjacent Incinerator Complex, with dewatered biosolids by means of two – 200 mm diameter high pressure pipelines. This state of the art biosolids transport system is controlled by the staff located in the incinerator complex control room, who regulate the high pressure biosolids pump feed rate to suit combustion and emission requirements within the incinerators.

The varying consistency of dewatered biosolids creates fluctuating levels of biosolids pumping high pressure. To assist with the control of the pump discharge pressures (2000 to 6000 kPa), due to biosolids dryness, an automatic pipeline lubrication system was provided to reduce this pumping discharge pressure.

Hydraulic Pressure Biosolids Pump

Biosolids Classifying Conveyors

SECTION 2

PROJECT HIGHLIGHTS CONT'D

The building itself has innovative features

The new building stacks the major elements of the process in a top down configuration based on the flow of material from the third floor Centrifuge gallery down to the basement where the final products, dewatered sludge and centrate, are pumped laterally through service tunnels to adjacent facilities.

The east end of the building features an open hoistway with stepped landings such that the centrifuge gallery bridge crane may access all levels of the building through to the ground level receiving area and basement process and storage facilities.

The new equipment has been laid out along the centreline of the building on each level with generous access aisles down the length of the building on both sides providing generous maintenance/ laydown space with natural light, full 360 degree access to machinery and clear drive lanes for equipment movement by forklift.

Heating Recirculation Pumps

Emulsion Storage Tank and Feed Pump

Lubrication Pumps and Storage Silo

SECTION 2

PROJECT HIGHLIGHTS CONT'D

2.2 COMPLEXITY

Several factors increased the complexity of the design of the new Dewatering Building. The new building site location was confined and constrained by a 3000 mm diameter trunk sewer to the north and an existing road and dewatering building to the south. To overcome these obstacles, the New Dewatering Building was developed into a three storey rectangular structure complete with a basement and access tunnels for utilities, piping and personnel. This design allowed for continued access to the main plant inlet trunk sewer.

The process complexity covers many parts from the varying liquid blended biosolids feed solids, to the polymer make up with dry or emulsion polymers and the centrifuge dewatering and conveyance of the dewatered biosolids sludge cake to the fluidized incinerators for combustion. Real time monitoring and controls assist the plant operating staff to make the necessary adjustments, in each process area, to produce the required daily biosolids through put in a timely and cost effective manner.

A crucial and complex process is the polymer make up system where polymer is made up at specific solution strengths to meet the varying quality of the feed sludge to be dewatered. Polymers are used as preconditioning chemicals prior to dewatering and causes coagulation and flocculation by reducing particle surface charge affects. Diluted polymer is injected into the dewatering centrifuge along with liquid blended feed biosolids where dewatered biosolids sludge cake and centrate are produced. The object is to produce the driest dewatered biosolids sludge cake while using the least amount of polymer.

2.3 SOCIAL AND/ OR ECONOMIC BENEFITS

Economic Benefits

The design and consequent LEED certification of this building contributes to the economic quality of life of the surrounding communities. Taxpayers save money through the decreased energy costs as a result of design, decreased costs for municipal water to irrigate the landscaping, and the 81% reduction of potable water consumption as a result of innovation use of effluent water.

Social Benefits

This Duffin Creek WPCP increases the social quality of surrounding communities. There are redundancies built into this process, ensuring that the plant is operable during all conditions. Residents are confident that their communities' wastewater is being treated properly and efficiently.

SECTION 2

PROJECT HIGHLIGHTS CONT'D

2.4 ENVIRONMENTAL BENEFITS

The building and process were designed to achieve the Canadian Green Building Council (CaGBC) LEED Gold Certification and adhered to the following five categories of LEED NC (New Construction) v1.0 Rating system:

- *SUSTAINABLE SITES:*
  - ✓ No disruption of natural habitats.
  - ✓ Bicycle secure storage and showers have been provided to a minimum of 5% of regular occupants
  - ✓ High albedo materials were used for 36% of non-roof impervious surfaces.
  - ✓ Exterior and interior lighting designed to significantly reduce light pollution.
  - ✓ Sediment and erosion control measures implemented during construction.

- *WATER EFFICIENCY:*
  - ✓ 100% reduction of municipal water needed for landscape maintenance.
  - ✓ 81.3% of total potable water consumption has been reduced as a result of innovative use of effluent water.

- *ENERGY AND ATMOSPHERE:*
  - ✓ significant building energy conservation features are:
    - – Building heating provided via heat recovered from an adjacent incineration complex.
    - – The heating distribution pumps equipped with variable frequency drives (VFD).
    - – Air handling units (AHU) equipped with heat recovery having effectiveness of 41.1%.
    - – AHU equipped with direct expansion (DX) cooling with an energy efficiency ratio (EER) of 11.2.
  - ✓ The energy performance simulation is 62.9% better than Model National Energy Code of Canada for Buildings (MNECB) reference building.

- *MATERIALS AND RESOURCES:*
  - ✓ The contractor developed and implemented a Construction Waste Management Plan. - 58.5% of total construction waste was diverted from landfill sites.

- *INDOOR ENVIRONMENTAL QUALITY*
  - ✓ Permanent carbon dioxide monitoring system in the selected rooms.
  - ✓ Low emitting paints, sealants, carpets and adhesives were used to keep the quality of the indoor air at the highest levels.
  - ✓ Special attention was given to provide maximum exposure to daylight.

SECTION 2

PROJECT HIGHLIGHTS CONT'D

2.5 MEETING CLIENT'S NEEDS

The clients' goal was to meet the wastewater treatment needs of an increasing population in an urban area, and to achieve LEED Gold Certification. When buildings are LEED Certified, the environmental quality of life is improved today and into the future. By incorporating the many LEED features already mentioned into the design of the building, the impact on the environment is minimized.

In order to reduce the exposure of the building occupants and maintenance personal to potentially hazardous chemical contaminants that adversely impact air quality, occupant well-being and the environment, the Owner put into effect the Green Housekeeping program in accordance with LEED requirements.

The Duffin Creek WPCP treats a significant amount of wastewater – it is the one of the top 10 processors of wastewater in Canada. This building contains state of the art biosolids processing and transporting equipment that will provide dewatering capacity for the next 20 to 30 years.

Main Entrance of Building

Entrance Sign

AECOM