GUIDELINES ON VALUATIONS
of Tangible Capital Assets for PSAB 3150

ROADS

DRAINAGE

WATER

SANITARY

Alberta

GUIDELINES ON VALUATIONS
of Tangible Capital Assets for PSAB 3150

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Purpose of this Guideline

This manual was produced for Alberta Municipal Affairs and is intended to assist municipalities to prepare for implementation of the Public Sector Accounting Board's Handbook Section 3150. The new accounting standard requires municipalities to record and report their infrastructure assets in their financial statements beginning in 2009. Federal, provincial and territorial governments have already complied with this standard.

The focus of this manual is non-provincial engineered public infrastructure (Tangible Capital Assets) consisting of:

- Roads and related infrastructure
- Drainage facilities related to roads
- Potable water systems; and
- Wastewater (sanitary) systems.

This manual applies to assets that a municipality has control and management over. This manual does not address land values as they are accounted for and recorded separately. Information contained in this manual addresses asset categorization, measurement, valuation and life cycles.

This manual is only intended to be used for a "one-time" valuation by municipalities for reporting under PSAB 3150 in 2009. It will provide some uniformity across Alberta for those municipalities that choose to use these guidelines. The manual is not intended to be used as an asset management tool or for valuing unique assets. Municipalities may choose to use other valuation methods and approaches based on existing asset management systems, recent cost data for newer infrastructure, or other sources of information.

The guidelines presented in this manual are based on information gathered from across the province through research and through consultation with municipal stakeholders at workshops in Leduc in July and November 2007, and in Calgary in July 2007.

Introduction (How to use this Guideline)

This manual provides information on meeting PSAB 3150 requirements for one-time valuations of the following asset categories:

- Roads and Related Facilities - Including paved and unpaved roads, paths and sidewalks, lighting, traffic guidance, and road-related drainage infrastructure which are intended for direct use of motorized and non-motorized vehicles and pedestrian travel. Bridges and other specialty and unique structures are not addressed in this manual.

- Drainage Facilities related to Roads.

- Public Potable Water Systems – Includes assets for the provision of water intake, treatment (limited information as treatment facilities are specialized and should be valued individually), storage and distribution.

- Wastewater (Sanitary) Systems - Including assets for the provision of collection, transmission and pumping, lagoon treatment, and mechanical treatment of used (waste) water that finds its way to public facilities. Wastewater treatment facilities are specialized and should be valued individually.

The categories identified are based on professional advice and input from various municipalities through the stakeholder workshops. It is recognized that at their discretion municipalities have the opportunity to utilize recent inventory and costing data and other categorization methods.

Infrastructure valuations utilized in this manual are based on each asset's typical useful (or maximum) expected life which varies depending on the asset's quality, and the prevailing municipality's maintenance practices[1]; and the costing data available for replacement of each category (item) as of 2006 in Alberta. Costing references have been Alberta Infrastructure and Transportation's (AIT) 2006 cost data, RS Means 2006 data, and engineering cost estimates available for projects across the province.

[1] Alberta Municipalities' GFOA Technical Working Group report

This Tangible Capital Assets Project toolkit recommends amortization based on the straight-line method. Each asset's economic use and maintenance costs are assumed to be the same each year and the amortization amount is determined by dividing the asset's original cost by its estimated life in years. This manual provides a replacement cost which then can be discounted back to provide an estimate of the asset's original cost.

It is recognized that costs vary throughout the province depending on geographic location, proximity to resources, site and environmental conditions, quality and quantity of materials used and availability, and level of effort related to planning, engineering and administration.

For the purpose of meeting PSAB 3150 requirements the following parameters are utilized in the proposed valuation for each category noted in this manual:

- Replacement cost year is 2006. This will provide recent available cost data reflecting construction cost increases in the province.
- Valuations are generally based on 2006 RS Means Alberta cost data, AIT province-wide 2006 construction cost data, and are cross-checked with other public municipality data where available.
- Added to asset replacement costs are:
  - Planning and engineering costs of 6% of the estimated construction value. Past engineering practice has generally shown planning and engineering costs of approximately 4-6% of the estimated construction cost for a typical public infrastructure if work is undertaken by the consulting industry.
  - Agency Administration costs of 5% of the estimated construction value. Recognizing that public agencies (owners) incur internal costs in planning, and administration and based on feedback from stakeholder consultations, a 5% cost is added to the construction costs for agency administration.[2]

[2] Costs vary depending on project complexities, such as design, permitting, etc. Municipalities may use other values as they see suitable.

  - o Procurement and construction administration of 6% of the estimated construction value. The 4-6% value is generally used as a guideline for estimating construction administration costs. A value of 6% is utilized to account for construction administration costs, whether administered by the agency or a consultant.
  - o Environmental and utility impact equivalent calculated at 10% of the estimated construction cost. It is recognized that environment and utility impacts applicability can vary widely.

- Asset operation and maintenance costs are not relevant to this “one time” PSAB 3150 valuation and therefore not compiled.

- Useful life is noted under each chapter for each asset.

- No salvage value is assigned.

- Straight line amortization is recommended.

- All assets are considered to have been built in the same year. For example, all segments of a road are considered to have been constructed in one year (base, asphalt, etc. and not transitioned in some cases from an unpaved road to a paved road). For example urban paved roads have often evolved from unpaved paths.

- Assets with an individual value <$500 are not included for valuation purposes, (for example single pole traffic signs). Municipalities may record these assets as a network if the cumulative value is significant, or as part of the total road cost

These are general guidelines on the approach to valuing the infrastructure categories provided in this manual. Municipalities are encouraged to use the recommended asset categorization and approach in measurement and valuation of assets discussed. However, the ultimate decision on the best approach for implementing PSAB 3150 requirements rests with the municipality in consultation with the independent auditor.

GUIDELINES ON VALUATIONS
of Tangible Capital Assets for PSAB 3150

ROADS

Alberta

1. ROAD INFRASTRUCTURE

Assets considered under Road Infrastructure include items that are directly relevant to roads and their related appurtenances. The categories noted below are based on expert input and feedback from various municipalities across Alberta during the consultation workshops.

Municipalities may choose to add or not to utilize all the asset categories noted in this chapter, depending on the cumulative value as part of the entire municipal asset base.

Items related to road infrastructure are categorized and discussed under the following headings:

1. Roads (paved and unpaved)
2. Curbs and Gutters
3. Sidewalks and Paths (including traffic islands)
4. Street Lighting
5. Traffic Signals and Controls

The approach taken to categorize road and related assets has been to define categories that are suitable for use by most municipalities across the province, whether urban, rural, large or small. There have been considerable discussions with various stakeholders regarding the most widely acceptable categories for a one-time valuation to meet PSAB 3150 requirements in 2009.

The above categories are intended to provide general coverage of road-related infrastructure. Transit-related facilities, landscaping, and non-customary infrastructure are not included. Municipalities are required to record these assets under PSAB 3150 if they control and manage the asset, and if the assets have considerable relative value.

The valuations shown in the following tables include mark-ups of the basic estimated construction costs as noted in the introductory chapter of this manual which include: 6% for planning and engineering, 5% for agency administration, 6% for construction administration, and 10% for environmental and utility impacts/mitigation.

1.1 Roads

Roads can be categorized by surface type (paved, unpaved, pavement thickness, materials and depths of each layer, construction type), traffic usage (axel loads and traffic volumes), and usage based on Transportation Association of Canada guidelines (Arterial, Collector, Urban, Rural, etc.), or a combination of the above. Based on a review of road categorization in municipalities of various population, geographic location and type (rural, urban,), and asset management capability, and, input from consultative workshops, it was apparent that there is little consistency across the province relating to road asset categorization. And, where there is similar terminology used, such as Arterial or Collector, etc., often there is not a consistent definition of the terminology amongst municipalities since there are no uniform design guidelines across the province. This is not unusual since road pavement designs are influenced by local factors such as local soil conditions, the environment, traffic, materials availability, historical transition from unpaved to paved roads, and local experiences.

This manual has categorized road-related assets under the following headings:

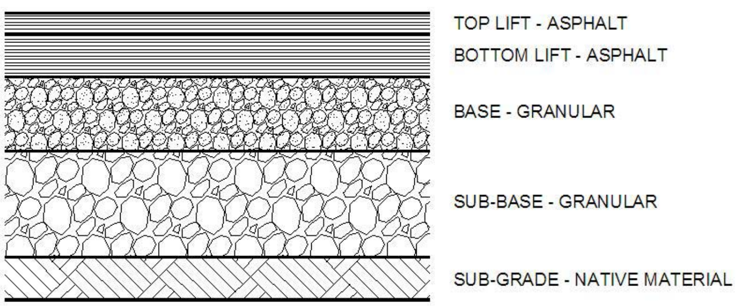
1. Paved Asphalt Concrete Roads
2. Cement Stabilized Base Course
3. Paved Portland Cement Concrete Roads
4. Unpaved Gravel Roads
5. Unpaved Surface-Treated Roads

Valuations noted in this document are based on the units of measure as described under each road category, and they include related infrastructure such as base and sub-base materials, grading, compaction, coatings and pavement markings for roads, which are not separately costed but are required to have an operating road.

1.1.1 Paved Asphalt Concrete Road (Flexible Pavement)

Municipalities generally have different pavement structure requirements (i.e. thickness of top lift, bottom lift, base course, sub base course, etc) for different road classifications (i.e. arterial, collector, industrial, residential, etc.). In order to present a unit cost that can rather easily be applied across the province for the purpose of PSAB 3150, asphalt pavements (also known as flexible pavements) have been categorized into four total asphalt depths: 200mm, 150mm-199mm, 100-149mm, <100mm. Consideration for top and bottoms lifts of asphalt, as applicable, is taken into account in developing the valuation (unit costs).

It is recognized that road base structures may vary, but it was collectively decided that the pavement thickness would be the primary categorization measure. The following table provides a summary of the categories and their preferred unit costs.



Typical paved road construction depiction

Table 1.1 Summary for Paved Asphalt Concrete Roads

Asphalt Concrete Depth	Nominal Asphalt Depth (for valuation)	Top / Bottom Asphalt Lift Thickness (Nominal typical)	Base Thickness (unpaved granular layer, Nominal)	Sub-base Thickness (unpaved, granular layer, Nominal)	Estimated Useful Life	Cost / m2 of Paved Roadway
200mm	200mm	50mm 150mm	175mm	350mm	20	$66
150-199mm	175mm	50mm 125mm	175mm	350mm	20	$62
101-149mm	150mm	50mm 100mm	175mm	250mm	20	$53
<100mm	100mm	50mm 50mm	200mm	250mm	20	$47

Items considered and the assumptions in unit price valuations noted in the above table include:

- The pavement thicknesses shown are nominal, combine top and bottom layers of asphalt into one layer, and are streamlined for typical road construction.
- The road construction costing includes native grade preparation, grading and compaction of granular layers, application of prime and tack coats, lane control, paving, pavement markings, and other related works necessary to build an operational road surface.
- One continuous centre directional dividing line and two lane dividing lines, and one stop bar and one intersection line per every 500 metres have been assumed.
- 6 road signs/km and $0.65m^2$/sign (referenced to AIT Best Practices Guidelines for Sign Materials).
- Costs are estimated based on 2006 AIT Unit price cost data and calibrated as required with 2006 RS Means Cost Data.
- Useful life of 20 years. (Consistent with AIT guidelines, Highway Geometric Design Manual). Other references have indicated 30 years with proper maintenance.
- On average, 48% of the per square metre unit cost is the asphalt surface, 26% is granular base, and 26% is preparation of the sub-base and grade.

1.1.2 Cement Stabilized Base Course Road (CTB)

Cement stabilized base course consists of a uniform mixture of sand or crushed aggregate, Portland Cement and water. Cement Stabilized Base Course is sometimes used for temporary patching, running road surfaces, or as a strengthened base material for paved roads. Typical usage of Cement Stabilized Base Course as a strengthened base material reduces the depth of untreated granular base materials.

For the purpose of this guideline and based on the feedback received from municipalities it is assumed that Cement Stabilized Base material will be used for the layer below asphalt pavement as a strengthening base. No new (imported) granular sub-base is assumed to be required.

A typical asphalt pavement structure with CTB is shown below:

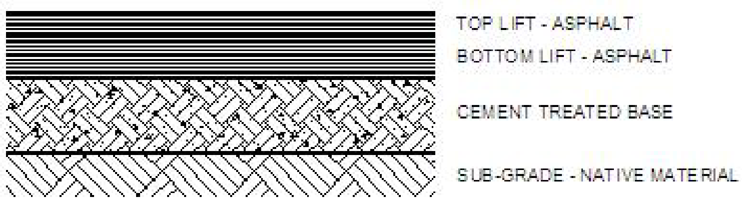


Table 1.2 - Summary for Cement Stabilized Base Course

Asphalt Concrete Depth	Nominal Asphalt Depth (for valuation)	Top / Bottom Asphalt Lift Thickness (Nominal typical)	Cement Stabilized Base Thickness (Nominal)	Sub-base Thickness (unpaved, granular layer, Nominal)	Estimated Useful Life	Cost / m2 of Paved Roadway
200mm	200mm	50mm 150mm	175mm	Native	20	$63
150-199mm	175mm	50mm 125mm	175mm	Native	20	$59
101-149mm	150mm	50mm 100mm	175mm	Native	20	$55
<100mm	100mm	50mm 50mm	200mm	Native	20	$49

Items considered and the assumptions in unit price valuations noted in the above table include:

- Cement stabilized base course is generally an added cost to the base material. However, the cement treated base material generally can be on a lower quality aggregate, Cement content (usually ranges between 3-10%) is based on desired strength and generally cement is applied in order to utilize soils already available on site. For the purpose of this guideline, 6% cement content has been assumed.
- The Cement Stabilized Base Course will eventually be paved over, and therefore the table above includes the costs for an asphalt concrete paved road with cement stabilized soils below it (base course). The road construction costing includes native grade preparation, grading and compaction of granular layers, application of prime and tack coats, lane control, paving, pavement markings, and other related works necessary to build an operational road surface.
- The pavement thicknesses shown are nominal, combine top and bottom layers of asphalt into one layer, and are streamlined for typical road construction.

- One continuous centre directional dividing line and two lane dividing lines, and one stop bar and one intersection line per every 500 metres have been assumed.
- 6 road signs/km and 0.65m²/sign (referenced to AIT Best Practices Guidelines for Sign Materials)
- Costs are estimated based on 2006 AIT Unit price cost data and calibrated as required with 2006 RS Means Cost Data. The Cement stabilized base cost is from RS Means.
- The useful life of just the cement stabilized layer, if exposed, is generally estimated at 10 years. But it is recognized that if placed under a paved road, the estimated useful life will be that of the paved road, and therefore a 20-year useful life is recommended for PSAB 3150 valuation purposes-consistent with the assumption for paved roads.
- On average, 48% of the per square metre unit cost is the asphalt surface, 48% is the CTB and 4% is the preparation of the grade and sub-base.

1.1.3 Portland Cement Concrete Road (Rigid Pavement)

Concrete (rigid pavement) roads are not as commonly used as asphalt roads (flexible pavements) - especially for municipal roads. They are typically constructed in colder climate or in areas with very heavy traffic loading- such as some bus lanes in cities. Concrete reinforcing wire mesh is typically used as 0.3%-0.6% of total cross sectional area of the concrete layer to prevent cracking. It is possible to design un-reinforced concrete roads. Thickness of concrete pavement (slab) is typically dependent on the design traffic load (weight) and ranges between 150mm and 350mm and slabs are constructed with joints between adjacent slabs. Concrete pavements are constructed over graded and compacted suitable soils (base and sub-base granular materials), but generally require less base and sub-base materials than asphalt roads. For the purpose of PSAB 3150 and based on the feedback received from various stakeholders, two typical depths of concrete road pavements are assumed and are summarized in the following table. The useful life for concrete roads is estimated as 30 years (as referenced in the Canadian Strategic Highway Research Program C-SHRP Technical Brief #23, April 2002: Pavement Structural Design Practices Across Canada) although well-constructed and drained concrete roads typically can last much longer in the order of 60-75 years.

A typical Portland Cement concrete pavement structure is shown below:

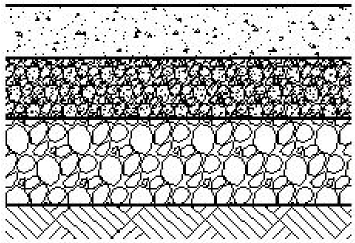


Table 1.3 - Summary for Portland Cement Concrete (Rigid Pavement) Roads

Concrete Depth (Nominal)	Base Thickness (unpaved granular layer, Nominal)	Sub-base Thickness (unpaved, granular layer, Nominal)	Estimated Useful Life	Cost / m2 of Paved Roadway
200mm	100mm	150mm	30	$132
300mm	100mm	150mm	30	$166

Items considered and the assumptions in unit price valuations noted in the above table include:

- The road construction costing includes native grade preparation, grading and compaction of granular layers, lane control, concrete surface paving, pavement markings, and other related works necessary to build an operational road surface. Due to the strength of the concrete, sometimes base and sub-base materials are combined into one layer.
- Includes joint, finishing, curing, steel reinforcement, transverse expansion joints, longitudinal joint tie bars. It is assumed that a typical concrete slab is 3.5m x 4m.
- One continuous centre directional dividing line and two lane dividing lines, and one stop bar and one intersection line per every 500 metres have been assumed.
- 6 road signs/km and 0.65m²/sign (referenced to AIT Best Practices Guidelines for Sign Materials).
- Estimated useful life of 30 years.
- Costs are estimated based on 2006 RS Means data.
- On average, 98% of the per square metre unit cost is the concrete pavement and 2% is the base preparation and grade.

1.1.4 Unpaved Surface-Treated Roads

Unpaved Surface Treated Roads for the purpose of this guideline include unpaved (gravel) roads that are applied with asphaltic emulsion to prolong surface life and prevent excessive dust, water penetration and wear. Chipseals are typically applied to paved roads. For the purpose of this manual and development of guidelines for PSAB 3150 purposes, the valuation shown below is developed based on costing for application of Chipseal type materials to unpaved roads. This includes the activities noted under Table 1.1.5 Unpaved Gravel Roads, plus the application of Chipseal material. The following table provides the assumptions in development of unit costs.

Table 1.4 - Summary for Unpaved Surface-Treated Roads

Road Surface Layer Thickness	Road Subgrade Preparation Thickness	Typical Road Width (including shoulder)	Typical Road Width (including shoulders & drainage ditches)	Estimated Useful Life (for the surface only)	Cost / Lane Kilometres
75mm	100mm	5 m	10 m	10	$360,000
75mm	100mm	10	20 m	10	$590,000

Items considered and the assumptions in unit price valuations noted in the above table include:

- The thicknesses shown are nominal and streamlined for typical construction.
- The road construction costing includes native grade preparation and compaction, adding imported granular layer and grading and compaction, and application of asphaltic emulsion.
- Ditches and culverts are included in the cost of the road. Continuous ditch is assumed on both sides of the road. A ditch is assumed on each side of the road, with four 14m long (driveway) culverts for every kilometre. A culvert crossing (perpendicular to the road) with length twice as wide as the road (i.e. 10m crossing for a 5m wide paved road surface) is also assumed.
- 2 road signs/km and 0.65m²/sign.
- Unpaved, surface-treated roads require intermittent grading, material addition and roadside ditch maintenance. These costs are not included as they are considered maintenance and not relevant to PSAB 3150.
- Costs are estimated based on 2006 AIT Unit Price cost data and reconciled with 2006 RS Means Cost Data.
- On average, 5% of the per lane kilometre unit price is the gravel surface and 95% is the preparation of the sub-base, grade and related components.

1.1.5 *Unpaved Gravel Roads*

Unpaved gravel roads are typically constructed by grading an undisturbed area, application of imported gravel materials, compaction and creation of ditches along the road. With increased volume over time, these roads often serve as the base material for paved roads. Unpaved roads generally require seasonal grading and maintenance, including ditch grading. These roads are generally in the countryside and are narrower than a typical urban paved road, but include some shoulder. For the purpose of this guideline, it is assumed that construction of gravel roads includes ditch creation along both sides of the road; one culvert every one kilometre crossing the road with a length of twice the road width; and four driveways accessing the road requiring 14-metre long culverts under them for drainage channelization.

The following table provides the assumptions in development of unit costs.

Table 1.5 - Summary for Unpaved Gravel Roads

Road Surface Layer Thickness	Road Subgrade Preparation Thickness	Typical Road Width (including shoulder)	Typical Road Width (including shoulders & drainage ditches)	Estimated Useful Life (for the surface only)	Cost / Lane Kilometres
75mm	100mm	5 m	10 m	10	$345,000
75mm	100mm	10	20 m	10	$560,000

Items considered and the assumptions in unit price valuations noted in the above table include:

- The road construction costing includes native grade preparation and compaction, adding imported granular layer and grading and compaction.
- Ditches and culverts are included in the cost of the road. Continuous ditch is assumed on both sides of the road. A ditch is assumed on each side of the road, with four 14m long (driveway) culverts for every kilometre. A culvert crossing (perpendicular to the road) with length twice as wide as the road (i.e. 10m crossing for a 5m wide paved road surface) is also assumed.
- 2 road signs/km and 0.65m²/sign.
- Costs are estimated based on 2006 AIT Unit Price cost data and reconciled with 2006 RS Means Cost Data.

- On average, 4% is the gravel surface and 96% of the unit cost is the preparation of the sub-base, grade and related components.

1.1.6 Non-engineered Roads

Non-engineered roads are typically constructed by grading an undisturbed area, application of imported gravel materials (and creation of ditches along the road). These roads generally require seasonal grading and maintenance, including ditch grading. These roads are generally in the countryside and are narrower than a typical urban paved road, as used for basic access. For the purpose of this guideline, it is assumed that construction of gravel roads includes ditch creation along both sides of the road.

The following table provides the assumptions in development of unit costs.

Table 1.6 - Summary for Non-engineered Roads

Road Surface Layer Thickness	Typical Road Width (including shoulder)	Estimated Useful Life	Cost / Kilometres
75mm	5 m	10	$15,000

Items considered and the assumptions in unit price valuations noted in the above table include:

- The road construction costing includes native grade preparation, adding imported granular layer and grading.
- Costs in Table 1.6 are based on unpaved gravel roads, surface only.
- Ditches are included in the cost of the road. Continuous grader constructed ditch is assumed on both sides of the road.
- Costs are estimated based on 2006 AIT Unit Price cost data and reconciled with 2006 RS Means Cost Data.

1.2 Curbs and Gutters

Roadside curbs and gutters are generally constructed of concrete or asphalt and are placed by machine or formed manually, and sit upon engineered soil materials. Sometimes curbs are placed (poured) monolithically with the adjacent sidewalk structure. Curbs and gutters are generally an urban road feature and primarily placed for drainage channelization. Barrier curbs (generally in the order of 150mm high) serve as a barrier between a vehicular travel lane and sidewalks or paths. Some curbs are primarily for drainage purposes and are designed as roll-over (mountable) curbs where vehicles can traverse them. Gutters, also called pans, can have varying widths.

Based on the feedback from various municipalities curbs and gutters have been categorized as: concrete curbs (as one category and height, 150mm average); concrete curb & gutter (uniform height, 150mm, and gutter width); asphalt curbs (uniform 150mm height) and monolithic curb, gutter and sidewalk.

Table 1.7 – Curbs and Gutters

Curb Type	Useful Life	Cost/Kilometre (one side)	Cost/Kilometre (Both Sides)
Concrete Curb	30	$105,000	$210,000
Concrete Curb & Gutter	30	$89,000	$178,000
Asphalt Curb	20	$50,000	$100,000
Monolithic curb, gutter and sidewalk	30	$270,000	$540,000

Items considered and the assumptions in unit price valuations noted in the above table include:

- The heights and gutter widths, as applicable are streamlined for typical construction.
- Sometimes grade preparation and compaction of base materials, and traffic control is generally undertaken as part of road base construction.
- Useful life as shown above. Generally asphalt curbs have a much shorter life span when adjacent to traffic lanes.
- A per kilometre unit of measure has been used for ease of use.
- Costs are estimated based on 2006 AIT Unit Price cost data.

1.3 Sidewalks and Paths

Sidewalks provide a defined path for pedestrians. Paths are generally designed and constructed to accommodate pedestrians and cyclists and other wheeled individual movers, and are generally wider than urban road sidewalks. Sidewalks are generally made of Portland Cement concrete, and sometimes asphalt concrete. Paths in many instances are made of asphalt concrete, concrete or stone in urban areas, and are unpaved (gravel, woodchip) in rural areas and parks. Unit pavers are sometimes used for aesthetic purposes, which generally have a shorter life span, and require more maintenance, than concrete surfaces.

Generally paved sidewalks are 1.5 metre wide and sit upon engineered substructure of imported gravels.

Table 1.8 – Sidewalks and Paths

Sidewalk / Path Type	Thickness (mm)	Base (mm)	Useful Life	Cost/m²
Sidewalk – Concrete (1.5m wide)	200	100	30	$110
Sidewalk / Path – Asphalt	100	200	20	$45
Sidewalk - Unit Paver		25	20	$30
Path - Stone/Gravel	50	200	10	$15
Traffic Island/Median - Concrete			30	$130

Items considered and the assumptions in unit price valuations noted in the above table include:

- The thicknesses shown are nominal and streamlined for typical construction.
- The unit costs noted include base preparation and sidewalk and path construction. Traffic control costs are not included, but are shown as part of road construction.
- Signage is not included in the above unit costs. Roadway unit costs include signage costs.
- Costs are estimated based on 2006 RS Means cost data.

1.4 Street Lighting

Streetlights are used on municipal streets to provide roadway and pedestrian environment illumination. The most common streetlight for municipal roads is the davit-type (“cobra-head”), which can be in a single- or double-head configuration. Single davits are used on the side of the roads and double-davits are usually used in medians. Where an aesthetic environment is desired, custom lights or luminaries are used. High-mast lighting is typically used for highway interchanges and sports parks. Wooden lights, or sometimes referred to as leased lights, use (shared) utility poles as the base. In this case, only a davit lamp is required. These lights are generally owned by the utility authority and municipalities pay a usage fee.

Spacing of street lights is based on the illumination levels required for each area.

Discussions from the workshops indicate that municipally-owned streetlights should be divided into the following categories:

Table 1.9 – Street Lighting

Type	Useful Life	Cost/each
Single Davit Street Light	30	$6,000
Double Davit Street Light	30	$8,000
Leased Light	30	N/A
Single Custom (low height)	30	$5,000
Double Custom (low height)	30	$6,000
High Mast	30	Specialized

Items considered and the assumptions in unit price valuations noted in the above table include:

- Streetlight base, standard and head , electrical conduits, boxes and wiring supply and installation
- Cost based on construction bids. It is noted that these widely vary due to the customization of lights
- High mast lights are usually used on highways and interchanges. As this report applies mainly to municpal assets, this item is not applicable.

1.5 Traffic Signals and Controls

Traffic signals are used to regulate traffic flow through intersections and to provide safe pedestrian crossings. They can be categorized by the number of lanes it spans (i.e. 2-lane vs. 4-lane). A typical intersection traffic light system includes the traffic light, LED, conduits, pole, and mast arms (e.g. 2-lane vs. 4-lane). Loop detectors are also an integral part of traffic signals for detecting car queue lengths and duration and interact with the system's computer to determine cycle (i.e. red- amber, green) length.

Table 1.10 – Traffic Signals

Signal Type	Useful Life	Cost/ea
Two-Lane	50	$289,000
Four-Lane	50	$385,000
Mid-Block Pedestrian Lights	50	$50,000

Items considered and the assumptions in unit price valuations noted in the above table include:

- Traffic signal base, standard, masts, LED signals, programmable controller, electrical conduits, wiring and communication systems supply and installation.
- Loop detectors and permissive left-turn lane controls.
- Pedestrian signals as an integrated part of the intersection signalization are also included.
- Cost difference between two- and four-lane signal is typically in the order of 25%
- Cost is based on 2006 RS Means price.

References

1. 2006 RS Means Heavy Construction Cost Data
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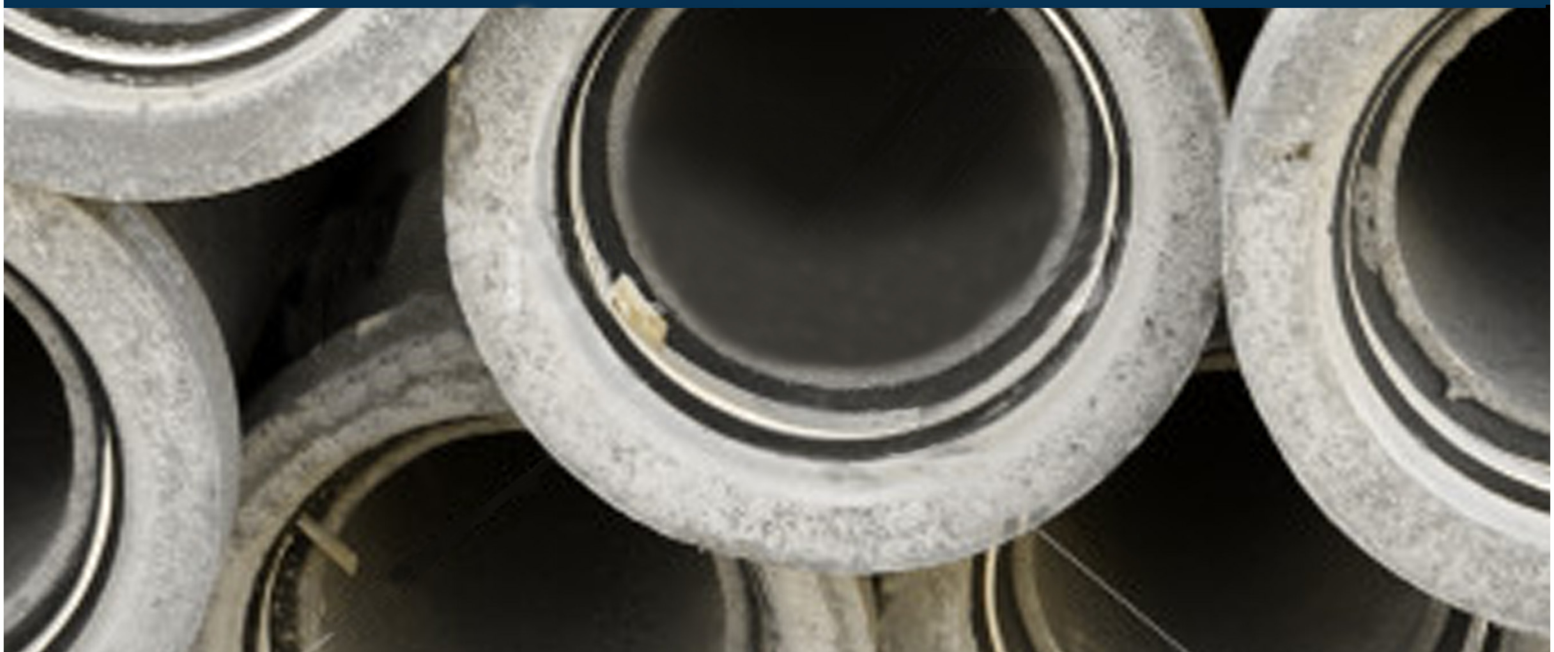
GUIDELINES ON VALUATIONS

of Tangible Capital Assets for PSAB 3150



DRAINAGE

Alberta

DRAINAGE

2. ROAD RELATED DRAINAGE

Discussions from the workshops indicate that road-related drainage should be divided into pipes and pumps for conveyance; and storage, detention ponds. Other features such as catch basins and manholes are included as a component of the above-noted categories.

2.1 Pipe

Road-related drainage involves a system of catch basins, manholes, storm pipes that carry storm water runoff to an outfall (e.g. stream, river, etc.). Pipes can be of varying sizes and categories - catch basin connection pipes/leads (100-150mm), and main conveyance pipes (250-600mm). Manholes in a piped system provide for changes in pipe direction and cleaning access and are placed typically per every 100m-200m of pipe length. Pipes sizes come only in distinct nominal pipe sizes. For the purpose of this manual, pipe sizes have been categorized into 3 sizes, made from concrete, and the unit prices include manholes and catch basins.

It is noted that major culverts can greatly vary in size, shape and material. Unpaved road costing in this manual includes assumptions for culverts as part of road costs. Other culverts not included in the following table must be costed separately. Major culverts >1.4m ∅ are considered a separate structure and classified as a bridge/structure. (See Highway Geometric Design Guide Section C.4.4)

Table 2.1 – Pipes

Drainage Feature	Useful Life	Cost/km
<250mm	50	**$266,000**
300-450 mm	50	**$219,000**
525-600 mm	50	**$287,000**
Catch Basins	50	**$3,600**

Items considered and the assumptions in unit price valuations include:

- Catch basins are priced separately.
- Ditch costing is included in unpaved road costs.
- The above cost includes pipe installation in a typical urban area, manholes at 100m intervals and trench excavation and fill. Cost data is based on 2006 RS Means data for Edmonton.

2.2 Detention Ponds

- Detention ponds are a tool in storm water management to control runoff from impervious surfaces such as pavements (i.e. a virgin forest will absorb much more rainwater and produce less runoff than a parking lot)
- Ponds are located outside of the road Right-of-Way.
- Municipal assets would only include public ponds, such as community detention ponds (i.e. excludes ponds located on private property to control site runoff before entering the storm system. Public ponds are usually built on publicly-owned land.
- Stormwater is controlled by a system of riser/orifices and/or emergency overflow weirs

AIT does not have unit prices for detention ponds. However, the US EPA Phase II NDPES Stormwater Management Program presents a National Menu of BMPs that prescribe how to estimate construction costs for a dry detention pond.

The equation is:

$C=12.4V^{0.760}$

Where:

C=Construction, design and permitting cost, and
V=Volume needed to control the 10-year storm (ft^3)

Using this equation, typical construction costs are

$ 41,600 for a 1 acre-foot pond

$ 239,000 for a 10 acre-foot pond

$1,380,000 for a 100 acre-foot pond

This equation was devised in 1996. Costs have to be adjusted for inflation and locale using the Engineering News Record’s construction cost index. The index between 1996 and 2008 is 1.44. The costs then become:

$59,904 for a 1 acre-foot pond (1233m^3)

$344,160 for a 10 acre-foot pond (12335m^3)

$1,987,200 for a 100 acre-foot pond (123348m^3)

Figure 2.1 shows a typical detention pond layout (from Fisheries and Oceans Land Development Guidelines for the Protection of Aquatic Habitat)

Figure 2.1 – Dry Detention Pond Plan and Sections

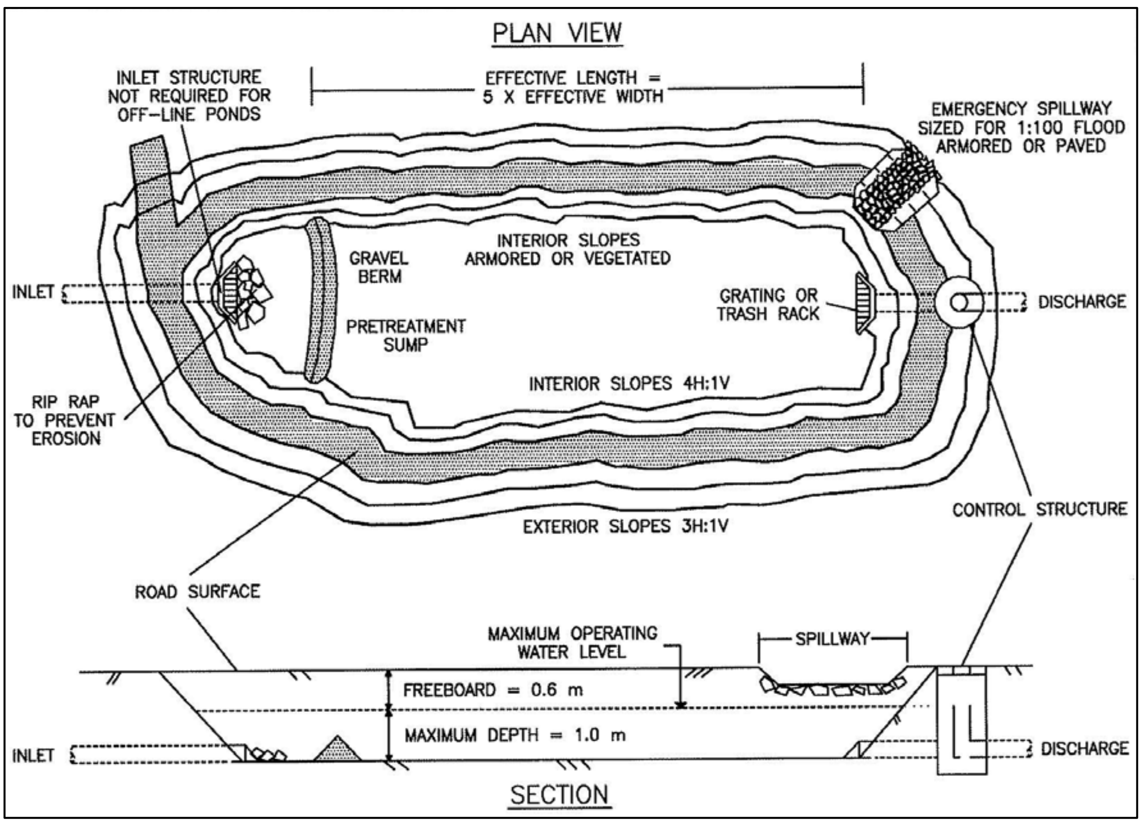


Table 2.2 – Stormwater Ponds

Volume (m³)	Useful Life	Cost ($/m³)
1000	75	**$ 42.21**
10000	75	**$ 24.29**
100000	75	**$ 13.98**

2.3 Stormwater Pump Stations

Stormwater pump stations are typically used in communities that have generally level terrain and/or are protected by dykes (i.e. situated at or below sea level), such as New Orleans, Louisiana in the USA. They are used where runoff from the collection system (See Pipes above) cannot be effectively drained by gravity to an outfall (e.g. stream, river, lake, etc.). In flat terrain, these pumps are used to effectively boost or "push" the stormwater through the collection system.

Discussions from the workshop indicate that unit prices for pump stations be categorized by horsepower (HP).

The useful life of Stormwater pump stations is assumed to be 45 years.

Table 2.3 – Stormwater Pump Stations

Drainage Feature	Useful Life	Cost
10 litres/sec.	45	150,000

References

1. 2006 RS Means Heavy Construction Cost Data
2. 2006 AIT Unit Prices
3. Land Development Guidelines for the Protection of Aquatic Habitat, Fisheries and Ocean, 2nd Printing, September 1993

GUIDELINES ON VALUATIONS
of Tangible Capital Assets for PSAB 3150

WATER

Alberta

3. WATER SYSTEMS

Categories discussed in the workshop included the source; covering surface water and groundwater; treatment systems, storage and distribution. There are a wide variety of systems serving various sizes of communities and raw water quality that are dealt with by municipalities. Treatment systems particularly were determined to be very unique to the community they serve and for that reason they will not be explored further in this manual. Replacement costs will need to be derived by the community itself based on original construction cost data or from suppliers' replacement costs.

This manual has categorized water system assets under the following categories and units of measure. Valuations include related components and infrastructure not shown elsewhere but are needed to form a complete package for that category. Populations for assumed for the three categories were 3,000, 15,000 and 30,000 residents. These populations were chosen to represent small, medium and large communities, respectively.

3.1 Water Source

3.1.1 Wells

For this category we looked at the three general sizes (small, medium and large) for well pumping systems based on the flow rate in m3/day and the depth of the well (shallow or deep). Costs include the drilling of the well, casing and screens, pumping, electrical and controls.

Table 3.1 – Water Wells

Depth (m)	Capacity (m3/d)		
	1,000	5,000	10,000
30m	$43,000	$62,000	$88,000
100m	$66,000	$120,000	$179,000

Items considered and assumptions in the price valuations include:

- The above costing includes well drilling, pump installation, steel well casing, well screen assembly, gravel pack, well development, pump testing, and well. The electrical and control costs accounted for a rotary valve used to regulate outlet pressure or flow.
- The Well System for 1000 m³/d at 30 m total dynamic head (TDH) is assumed to be submersible with specification ratings of: 183 USGPM 10 HP, 3600 RPM, 600V, 3 PH, c/w 50 M cable spliced on. This well is assumed to have a 6” internal diameter.
- The Well System for 1000 m³/d at 100 m total dynamic head (TDH) is assumed to be submersible with specification ratings of: 183 USGPM 25 HP, 3600 RPM, 600V, 3 PH, c/w 120 M cable spliced on. This well is assumed to have a 6” internal diameter.
- The Well System for 5000 m³/d at 30 m total dynamic head (TDH) is assumed to be submersible with specification ratings of: 917 USGPM, 40 HP, 3600 RPM, 600V, 3 PH, c/w 50 M cable spliced on cable spliced on. This well is assumed to have a 10” internal diameter.
- The Well System for 5000 m³/d at 100 m total dynamic head (TDH) is assumed to be submersible with specification ratings of: 917 USGPM, 125 HP, 3600 RPM, 600V, 3 PH, c/w 120 M cable spliced on. This well is assumed to have a 10” internal diameter.

- The Well System for 10,000 m³/d at 30 m total dynamic head (TDH) is assumed to be submersible with specification ratings of: 1835 USGPM, 100 HP, 3600 RPM, 600V, 3 PH, c/w 50 M cable spliced on. This well is assumed to have a 12" internal diameter.
- The Well System for 10,000 m³/d at 100 m total dynamic head (TDH) is assumed to be submersible with specification ratings of: 1835 USGPM, 250 HP, 3600 RPM, 600V, 3 PH, c/w 120 M cable spliced on. This well is assumed to have a 12" internal diameter.
- Please note the above well system specifications are for reference purposes only. Each municipality must ensure that a detailed design is completed for any unique water system requirements.
- The thresholds were based on communities with populations of approximately 3,000, 15,000, and 30,000 people, respectively. A 300 L/ca/d factor was used to determine the flows.
- The above Well System costs do not include a building or enclosure.
- The Well system prices do not include site delivery, design and engineering, or contingencies.
- The well system prices do not also account for the options of cast iron or stainless steel impellers; bowl and impeller wear rings (enclosed impellers); enclosed line shafting for external lubrication; vertical Solid Shaft motors c/w flanged couplings; motor winding and bearing Resistance Thermal Detectors (RTD); motor complete testing to Institute of Electrical Electronics Engineers (IEEE) 112.

3.1.2 Surface Water Source

For this category we examined the intake structure and Raw Water pumping based on three general sizes (small, medium and large) for pumping systems based on the flow rate in m3/day. Costs include concrete intake structure, screens, pumping, electrical and controls. They do not include any raw water storage or secondary pumping systems.

Table 3.2 – Water Intake Structures & Raw Water Pumping

Capacity (m3/d)		
1,000	**5,000**	**10,000**
$324,000	$454,000	$635,000

- The costing was estimated for a raw water pump station that includes valve chambers, intake structures and steel walkways. The above prices include the supply of all equipment, labour and materials to excavate, backfill, construct the surface water pump station, valve chamber, intake structure, concrete pipe, knife gate, foundation supports, catwalk, screen, and install mechanical equipment.
- The cost for this raw water pump station, valve chamber, intake structure and steel access walkway include the following appurtenances:
- *Pump Station and Valve Chamber*
  - Access hatch
  - Ladder rungs
  - 150mm diameter electromagnetic flowmeter
  - Precast concrete vault for valves
  - Precast concrete vault for pumps
  - 150mm diameter gate valve (2 units)
  - 150mm diameter check valve (2 units)
  - Submersible pump (2 units)
  - Alarm and electrical system
  - Exhaust vent
  - Weatherproof control box
- *Intake Structure including Steel Access walkway to Intake Screen*
  - Control valve
  - 600mm diameter concrete pipe
  - Flange and screen
  - Manual operated knife gate
  - Steel grating with 25mm bearing bars
  - 42mm pipe handrail system
  - Platform framing, foundation support and concrete anchoring
  - 300mm diameter concrete piling
- The Water Intake System for 1,000 m^3/d at 10 m total dynamic head (TDH) is assumed to be a vertical turbine pump with specification ratings of: 183 USGPM, 3 HP, 1200 RPM, 600V, 3 PH.
- The Water Intake System for 5,000 m^3/d at 10 m total dynamic head (TDH) is assumed to be a vertical turbine pump with specification ratings of: 917 USGPM, 10 HP, 1200 RPM, 600V, 3 PH.
- The Water Intake System for 10,000 m^3/d at 10 m total dynamic head (TDH) is assumed to be a vertical turbine pump with specification ratings of: 1835 USGPM, 20 HP, 1200 RPM, 600V, 3 PH.
- The thresholds were based on communities with populations of approximately 3,000, 15,000, and 30,000 people, respectively. A 300 L/ca/d factor was used to determine the flows.

- Please note the above surface water system specifications are for reference purposes only. Each municipality must ensure that a detailed design is completed for any unique water system requirements.
- The surface water system prices do not include site delivery, design and engineering, or contingencies.

3.1.3 Water Treatment

Water Treatment Plants vary too widely to be discussed on a general basis here and will be left up to each community to determine their respective value.

3.2 Treated Water Reservoirs & Pumping

3.2.1 Reservoirs

For this section we looked at concrete in-ground reservoirs as the base and developed the cost on a per cubic metre of volume of water stored. The costs include excavation and backfill and all integral internal piping and related components.

Table 3.3 – Water Reservoirs

Capacity (m3)		
3,000	**15,000**	**30,000**
$2,250,000	$11,250,000	$22,500,000

- The thresholds were based on communities with populations of approximately 3,000, 15,000, and 30,000 people, respectively. A factor of 300 L/ca/d was used to determine required reservoir storage along with accounting for the requirement of emergency fire storage.

Distribution Pumping Systems

This section includes the pumping system, controls and building usually constructed on/as part of the treated water reservoir. We have provided costs for three capacities and related that to average pumping head.

Table 3.4 – Water Distribution Pump Station

Capacity (m3/d)		
1,000	**5,000**	**10,000**
$405,000	$567,000	$794,000

- The above prices include the supply of all equipment, labour and materials to excavate, backfill, construct the distribution pump station, and install mechanical equipment.
- The cost for this distribution pump station includes the following appurtenances:
  - Pumping Unit (2 units)
  - Meter (2 units)
  - Valve (2 units)
  - Piping to a point 4.0m beyond the reservoir
  - Simple Building Enclosure
  - Electrical and controls including stand-by generator set, transfer switch, motor control centre, distribution, lighting, controls and instrumentation, communications, and commissioning of facilities.
- The Water Distribution System for 1,000 m³/d at 70 m total dynamic head (TDH) is assumed to be a vertical turbine pump with specification ratings of: 183 USGPM, 15 HP, 1800 RPM, 600V, 3 PH.
- The Water Distribution System for 5,000 m³/d at 70 m total dynamic head (TDH) is assumed to be a vertical turbine pump with specification ratings of: 917 USGPM, 75 HP, 1800 RPM, 600V, 3 PH.
- The Water Distribution System for 10,000 m³/d at 70 m total dynamic head (TDH) is assumed to be a vertical turbine pump with specification ratings of: 1835 USGPM, 150 HP, 1800 RPM, 600V, 3 PH.
- Please note the above distribution pumping system specifications are for reference purposes only. Each municipality must ensure that a detailed design is completed for any unique water system requirements.
- The distribution water system prices do not include site delivery, design and engineering, or contingencies.

Distribution Systems

The piped distribution system is the next component in the water system. Costs are provided for three representative pipe diameters on a per kilometre basis and include trenching & backfill, pipe, gate valves, hydrants & fittings.

Table 3.5– Water Distribution Pipe System

Diameter (mm)		
150	**200**	**300**
$320,000	$335,000	$365,000

- The above costs do not include the removal and disposal of any existing pipes.
- Assumes use of PVC pipe.
- Please note the above distribution pumping system sizes are for reference purposes only. Each municipality must ensure that a detailed design is completed for any unique water system requirements.
- The distribution water piping prices do not include site delivery, design and engineering, or contingencies.
- Lift stations or pumping systems within the sewer collection system are in 4.2 following.

GUIDELINES ON VALUATIONS
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SANITARY

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4. WASTEWATER SYSTEMS

4.1 Collection System

The piped sewage collection system is the starting place in the wastewater system. Costs are provided for three representative pipe diameters on a per kilometre basis and include trenching and backfill, pipe, and manholes.

Table 4.1 – Sewage Collection System

Diameter (mm)		
200	250	300
$320,000	$335,000	$350,000

- The above costs do not include the removal and disposal of any existing pipes. Costs also do not take into account special procedures, which may be required for the safe removal and disposal of Asbestos Cement pipe.
- Assumes use of PVC pipe.
- Please note the above collection system pipe sizes are for reference purposes only. Each municipality must ensure that a detailed design is completed for any unique sanitary system requirements.
- The sanitary piping prices do not include site delivery, design and engineering, or contingencies.

4.2 Lift Stations

There are areas within a sewer system that cannot reach the treatment plant via gravity. In those instances a pump or lift station is need to lift the sewage to a higher elevation before it can continue by gravity to the treatment facility. There are two basic types of facilities: wet well & dry well. Larger stations tend to be dry well with the pumps & piping located in a separate chamber rather submersed in the wastewater. The representative costs provided are based on a given flow rate and include the excavation, pumps, tank, controls and enclosure.

Table 4.2 – Sewage Lift Station

Capacity (m3/d)		
1,000	**5,000**	**10,000**
$266,000	$460,000	$720,000

- The above prices are for a packaged wet well lift station. This cost includes the excavation, submersible pumps, pipes, appurtenances, and enclosure for a complete station.
- The thresholds were based on communities with populations of approximately 3,000, 15,000, and 30,000 people, respectively. A 300 L/ca/d factor was used to determine the flows.
- Please note the above lift station system costs are for reference purposes only. Each municipality must ensure that a detailed design is completed for any unique system requirements.
- The lift station prices do not include site delivery, design and engineering, or contingencies.

4.3 Sewage Treatment

4.3.1 Septic Tanks & Disposal Fields

Septic systems are generally suited to smaller public facilities. Costs are generated based on the size of the septic tank and include and allowance for the disposal field assuming average soil conditions.

Table 4.3 – Septic Tank & Disposal Field

Septic Tank and Disposal Field
$25,000

- The above cost includes construction of a septic tank and disposal field for typical 4-bedroom single-family dwelling.
- This price assumes a medium draining soil (i.e. loam). It includes the supply and installation of a septic tank, connection piping, perforated piping, drainage rock, excavation and backfill.
- Please note the above lift station system costs are for reference purposes only. Each municipality must ensure that a detailed design and/or geotechnical testing is completed for any unique system requirements.
- The septic tank and disposal field costs do not include site delivery, design and engineering, or contingencies.

4.3.2 Lagoon Treatment

The next level of sophistication in wastewater treatment is via the use of sewage lagoons. A series of ponds allows the solids to settle and digest and storage time for the natural microbes to digest the organic materials in the wastewater. Additional storage allows the discharge of the treated effluent to be controlled to once, or in rare instances, twice a year. Costs are based on the volume of the lagoon system and include earth works and integrated piping and valves.

Table 4.4 – Sewage Lagoon

Size (m3)		
435,000	**2,145,000**	**4,330,000**
$4,450,000	$21,610,000	$43,510,000

- The thresholds were based on communities with populations of approximately 3,000, 15,000, and 30,000 people, respectively.
- Alberta Environmental Guidelines have three categories to determine if you need anaerobic cells, based on daily design flow rates (m3/day): less than 250 m3/d (0 anaerobic cells required), 250 to 500 m3/d (2 cells), and greater than 500 m3/d (4 cells). Anaerobic cells have a retention time of 2 days each, facultative cells are used for 60 day storage, and storage cells are used for 12 month (or 365 day) storage. The above lagoon treatment system sizes were based on these guidelines.
- Please note the above sizes are for reference purposes only. Each municipality must ensure that a detailed design is completed for any unique system requirements.
- Construction includes a 4-strand barbed wired fence around the lagoon.

- Construction includes 4 groundwater monitoring wells – no pump is included.
- The lagoon construction prices do not include site delivery, design and engineering, or contingencies.
- It is assumed that native clay was used to line the lagoon. Does not include use of plastic liners.
- Includes monitoring wells and fencing.

4.3.3 Mechanical Treatment Plants

Mechanical Wastewater Treatment Plants vary too widely to be discussed on a general basis here and will be left up to each community to determine their respective value.

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