LIQUID WASTE MANAGEMENT PLAN (LWMP) for the COMOX VALLEY SEWERAGE SYSTEM (CVSS)

Joint Technical Advisory Committee and Public Advisory Committee (TACPAC)

Meeting #5 February 8, 2019

Finalizing the Long List Options

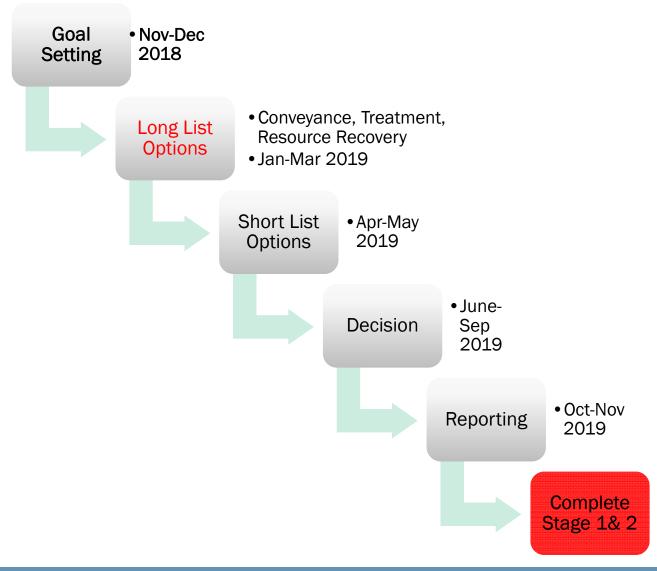


Today's Agenda

- Quick review of LWMP process
- Developing ideas for use of reclaimed water
- Review of public feedback on Long List Options
- Finalize Long List Options and recommend to CVSC for Conceptual Study
 - Conveyance
 - Treatment
 - Resource Recovery
- Technical Update
 - Understanding Cost Estimates
 - Conveyance Hydraulics



LWMP Road Map - CVSS Stage 1 & 2





What happens with the Long List?

- 1. WSP develops a conceptual study of the long list options (one month)
- 2. The TACPAC reviews them at Meeting #6, March 21
- 3. Run long list options through the evaluation system and develop short list
- 4. Confirm results reflect committee's input
- 5. Short list options for detailed study



What happens with the Short List?

- 1. Recommend the short List to the Comox Valley Sewage Commission (April 16).
- 2. TACPAC review of detailed studies at Meeting #7
- 3. The short list options are released for **final** stage of public consultation and input (April/May)
- 4. Feedback from Public Consultation and final evaluation of short list options at Meeting #8
- 5. Recommend to CVSC, decision in September



LWMP Stage 1&2 Report

Purpose is to document the process

- The goal setting
- Long list studies and decisions
- Short list studies and decision on preferred option
- Simplified financing analysis

Target date for completion is end of 2019



LWMP Report

Includes other technical studies, information, recommendations

- Population, flow and loads
- Regulatory aspects
- Environmental aspects (outfall)
- Infiltration & inflow
- Water conservation
- Biosolids management



Important Dates

Date	Activity					
March 21	TACPAC 6 – Evaluate Long List, recommend Short List to CVSC					
April/May (TBC)	Online consultation for short list options					
Week of May 20 th /27 th (TBC)	TACPAC 7 Review Short List options, public & online feedback, preliminary evaluation					
May 29&30	Public Workshop #4 – review and rank Short List options					
June 13 th (TBC)	TACPAC 8 – finalize evaluation to recommend Preferred Option(s), recommend to CVSC					
Sep	CVSC to decide on Preferred Options and report back to community					
Fall	TACPAC 9 reviewing draft Stage 1&2 LWMP Repo					
Fall	TACPAC 10 recommend report to CVSC for submission to Min of Environment.					



How to use Reclaimed Water?





Closing the Loop on Resource Recovery.

Resources are only truly "recovered" when they are actually *reused*.

The *engineering* side of resource recovery is relatively straightforward.

Making *productive use* of the resources, especially water, is much harder.



Why is it so hard to use reclaimed water?

- Cost of *producing* the water
- Cost and logistics of *conveyance* to users
- Largest use irrigation is seasonal & weather dependent
- The perceived "ick factor" about "recycled sewage"



How to resolve these issues?

- If there is *enough* water being used *and paid for* the costs become "worth it"
- *Cannot change* the fact that irrigation is a summer use
- Can change the perception of the ick factor through *engagement*
- Can change the reality of the ick factor through *appropriate treatment* make the water "fit for purpose".



Today's challenge -

Identify "Users" and "Uses" of reclaimed water

If we can find enough of both, it might be "worth it" to do reclaimed water



What are the "Uses"?

The *specific activities* using the water e.g.:

- toilet flushing,
- landscape irrigation
- agricultural irrigation
- washing buses
- concrete mixing



Who are the "Users"?

The people and/or places that are doing the uses e.g.:

- A city park
- Hotel
- Farm
- Airport

One User might have multiple Uses.

One Place might have multiple Users



The action statement

Use Reclaimed Water at Place by User for Use

Example:

Use reclaimed water at <u>Airport</u> by <u>Airlines</u> for <u>aircraft washing</u>.



One Place and/or User having Multiple Uses

Use reclaimed water at Airport by Airlines for;

- Aircraft washing.
- Flushing toilets
- Flushing toilets on aircraft
- Irrigating the grounds
- etc.



Exercise - Identify the Places

Use the Red notes examples;

- Courtenay downtown
- Comox waterfront
- K'omoks First Nation
- Estuary Farm area
- Lazo Beach
- Airport
- Sandwick
- Other Locality—be specific e.g BC Ferry Terminal



Exercise – Identify the Users

Write down a **specific user** –real or potential- of reclaimed water. Concentrate on the ones in your area. Use the yellow notes

e.g;

- XYZ Hotel
- dairy farm
- hay farm
- golf course,
- widget factory,
- Comox Parks dept.
- Residential



Exercise – Identify the Uses

Write down a **specific use** –real or potential- of reclaimed water. Use the green notes e.g.

- Irrigating hayfield
- Irrigating tomatoes
- Washing buses
- Washing boats
- Augmenting flow to the wetland, creek
- Flushing toilets
- Processing cowhides to leather



What to do with all this?

- We will compile and sort the Places, Users and Uses
- This will be reported back to the TACPAC with the study of reclaimed water
- The TACPAC can identify promising combinations that merit further study
- Some study may done by others e.g. economic development entity, DND, etc



Liquid Waste Management Plan

LONG LIST PUBLIC CONSULTATION



Phase 3 Goals

INFORM	CONSULT	INVOLVE	COLLABORATE	EMPOWER
Provide info on options and planning stage	Obtain feedback on alternatives and decisions			

Increasing level of public involvement in decision-making



Engagement Summary

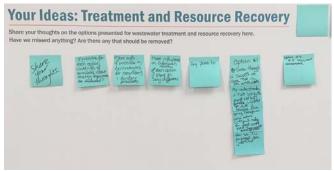




Phase 3 Info Sessions









Themes of Feedback



Protection of the foreshore



High treatment standards



Consider the cost



Comox 2 opposition



Next Steps

Review and rank Shortlisted Options:

- February (TBD) Present Long list options to KFN Chief and Council
- May 29 + 30 (tentative)
 Workshops in Courtenay & Comox
- May (TBD) Workshop for KFN community
- April/May (dates TBC)
 Online Consultation: Connect CVRD



LWMP Public Consultation Plan

QUESTIONS?



Long List Options - Conveyance

Need to decide the Long List [WSP]



Long List Options – Treatment

Need to decide the Long List [WSP]



Long List Options – Resource Recovery

Need to decide the Long List [WSP]



Technical Update

- 1. Understanding Cost Estimates
- 2. Conveyance Hydraulics

[WSP]



Understanding Engineering Cost Estimates



Understanding Engineering Cost Estimates

Costing "Catch-22"

- Cost estimates are needed to filter/rank options
- Insufficient options development to define costs
- Addressed through cost estimate Classifications



Definitions and Terms

- Class A to D
 Former Treasury Board of Canada cost classification definition
- Class 1 to 5

 Association for the Advancement of Cost Engineering (AACE) definitions



Project Development

Class A to D Estimates

Table $1-Cost$ Estimate Classification Summary $-Estimate$ Attributes								
	Primary Attribute	Secondary Attributes						
Estimate Classification	Project Definition	Intended Purpose	Methodology	Level of Precision	Preparation Effort			
Class A Property	High (completed working documents)	Compliance with effective project approval (budget)	Measured, priced, full detail quantities	High	High			
Class B (Substantive)	Medium (completed design development)	Seeking effective project approval	Mainly measured, priced, detail quantities	Medium	Medium			
Class C (Indicative)	Low (project plan)	Seeking preliminary project approval	Measured, priced, parameter quantities, where possible	Low	Low			
Class D	Lowest (described solutions)	Screening of various alternative solutions	Various	Lowest	Lowest			



Project Development

Class 1 to 5 Estimates

	Primary Characteristic	Secondary Characteristic				
ESTIMATE CLASS	MATURITY LEVEL OF PROJECT DEFINITION DELIVERABLES Expressed as % of complete definition	END USAGE Typical purpose of estimate	METHODOLOGY Typical estimating method	EXPECTED ACCURACY RANGE Typical variation in low and high ranges [a]		
Class 5	0% to 2%	Concept screening	Capacity factored, parametric models, judgment, or analogy	L: -20% to -50% H: +30% to +100%		
Class 4	1% to 15%	Study or feasibility		L: -15% to -30% H: +20% to +50%		
Class 3	10% to 40%	Budget authorization or control	Semi-detailed unit costs with assembly level line items	L: -10% to -20% H: +10% to +30%		
Class 2	30% to 75%	Control or bid/tender	Detailed unit cost with forced detailed take-off	L: -5% to -15% H: +5% to +20%		
Class 1	65% to 100%	Check estimate or bid/tender	Detailed unit cost with detailed take-off	L: -3% to -10% H: +3% to +15%		



Level of Accuracy

Class 'D' or '5'
-20% to +100% variability

Class 'C' or '4'
-15% to +50% variability

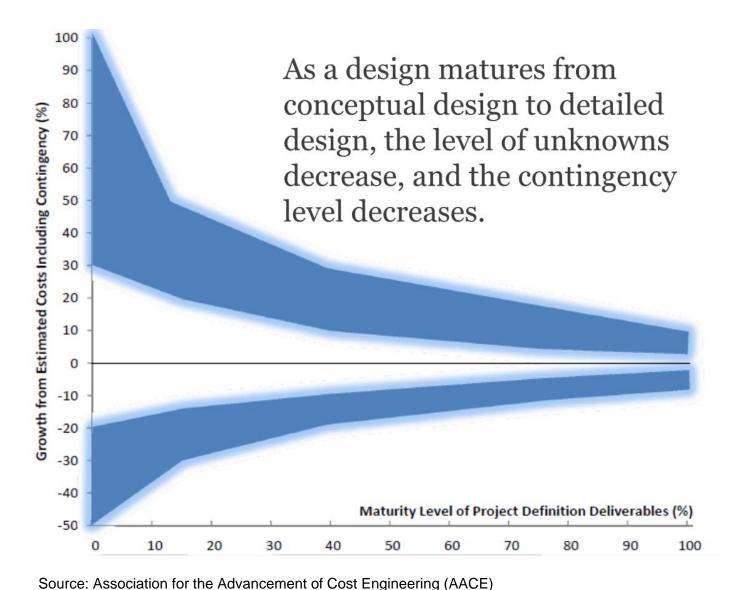
Class '3' -10% to +30%

Class 'B' or '2' -5% to +20%

Class 'A' or '1'



Level of Accuracy

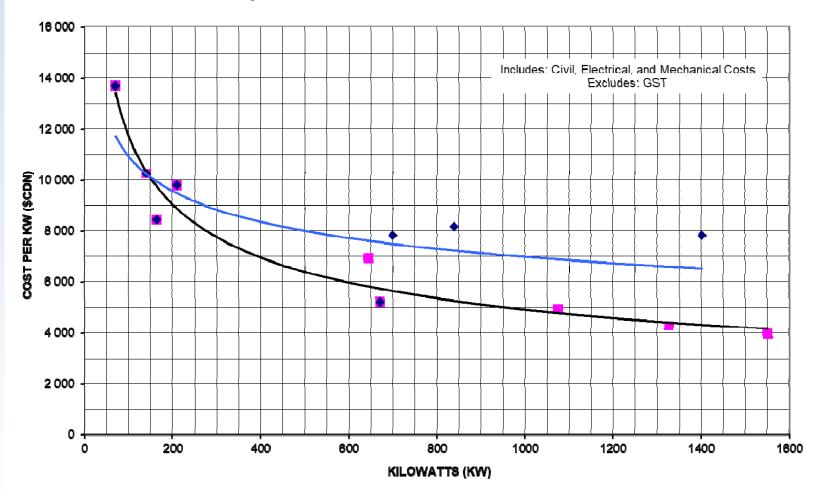




Cost Curves

PUMPING - KILOWATT VS COST PER KW

* All Pricing is based on the ENR Construction Cost index of 7723





Detailed Estimates

- Construction estimates typically contain hundreds of line items
- Anticipate a ±20% spread even at tendering

Mary										
Column	Dkcipline Civil-Align	Location Alignment	Description Foreshore Tie-in at the bottom of Seech St.	QTY	LS.	Unit Cost 5 1769 683	Labour Factor	Mark-up Factor 1.15	Purchase/Labor 90.0	Notes
Column	Civê-Align Civê-Align Civê-Alien	Nignment Nignment	Pressuraed 70" MH, 6" rise, lid, hatch Edi spools to FM Flowmeter 54"00 MH	1.0	ES. ES.	5 52 000 5 66 0W	1.15 1.15 1.15	1.15 1.15 1.45	\$7 273.8 \$68 770.0 \$87 291 ii	
Column	Civê-Align Civê-Align	Alignment Alignment	Bolistion Gate Valve Se [*] Ob Se [*] OD HOPE DR21 (80PSI)	2.00	69	\$ 115,000 \$ 1,318	115	1.15	\$304 175.0 \$4 359 158.4	Fright aboved Se*OD DR21(80 ps) - Se* DR21 x 60* - \$1318.46 /estr
Column	Civê-Align Civê-Align	Kigsmeet Kigsmeet	HDPS Pipe Joints HDPS Pipe Insight	166.7 82.0	ea Loads	\$ 1400 \$ 7450	1.15	1.15 1.15	\$208 583.3 \$702 714.9	fusing and labour from Corix Fisum Corix (9007 truck load)
Column	Civê-Align Civê-Align	Alignment Alignment	65mm asphalt pavement Trenching backfill - coarse aggregate	12 500.0 5 550.0	m'	S 45 S 17	1.0	1.15	\$646 875.0 \$162 753.8	65Means 22 12 16 13 0130 Emerald
Column	Civê-Align Civê-Align	Nigoment Nigoment	Trenching backfill - utility bedding Backfill material hauling	21 726.0 27 236.0	w,	S 52	100	100	\$1 661 047.1 \$268 349.2	KSMAssac 31 23 23: 16 Average 2mile hauling KSMSANS 21 23 23:20
A	Civê-Align Civê-Align	Kigsmeet Kigsmeet	Treocratig sucusation "Of Supply watermain Comm. mohalt maximum	500.0 2 500.0	- 0	5 90	115	115	\$59 \$12.5 \$136 275 #	Average common earth exclusions robbs Arts \$1,24 Fram Corts 6Channer 29 12 16 12 0120
Section Sect	Civil-Align	Nigoment	Supply water partners. Supply waternain Trenching backfill - coarse aggregate Supply waternain Trenchine hardfill - etilis backfile	210.0	m'	S 17	150	115	56 158 3 C7 64 5 7	i merald
Mary	Civil-Align	Alignment Alignment	Supply watermain Trenching Excauation Curtis Road Fortis BC 60mm DP Gas line mitiatation for construction	360.0	m'	S S	120	100	\$1979.1 \$ 7,000.00	
Section Sect	Ovi-Site	General	Site Clearing and Grubbing for linear work	22 400.0	m'	S S			\$112 000.0	
Section	Ovii-Site Ovii-Site	General General	Tree Replacement Well replacement	4.0	69	\$ 800 \$ 2500	12 10	1.00 1.00	\$5,760.0 \$10,000.0	From Emerald Tender From Wet Sowet En
Section	Ovil-Site Ovil-Site	General General	65mm asphalt pavement - Sx17.6m driveway 156mm crushed gravel base	88.0 52.4	m²	\$ 45 \$ 17	1.0 1.5	1.15	\$ 4554 \$ 1537	ISMeans 32 12 16 13 0130
Section	Ovi-Site Ovi-Site	General General	500mm subbase gravel PS Site Clearing and Grubbing	900.0	m'	3 3	1.0	1.15	\$ 1729 \$4500.0	65Means 31 11 10.10 0000, assume 20000 for main site plus another 700m2 for staging and laydows.
The column	Ovil-Site Ovil-Site	General General	stropping to Joseph away go depth and stockpile 1op soil Site Grading Hawling dirt away from site	25.0	LS. Truckload	5 120	1.0 1.0	1.00 1.15 1.00	\$27,000.0 \$0.0 \$4,200.0	GMeans 21 24 12 22 24 40 GMeans 21 22 13 0300 GMeans 11 22 22 22 20 0024
Marie Mari	Ovil-Site Ovil-Site	General General	Imported structural fill including hasting Deep Eucavation	0.000	m²	\$ 50 \$ 50	1.0	1.00	\$5,000.0 \$297,500.0	Undetermined without geotech Undetermined without geotech
Manual	Ovi-Site Ovi-Site	General General	Shallow Excavation Shoring	1280.0	m²	\$ 25 \$ 100	1.0	1.15		
Column	Ovil-Site Process-Mechanical	General Wet Well	Site Dewatering SLG 1110	1.0	d ea	\$ 1000 \$ 25000	1.0	100	\$60,000.0 \$46,287.5	Not considered currently due to absence of geatech Prorated from supplier pricing AVX values
Section	Process-Mechanical Process-Mechanical	Wet Well On Well	LA/UT 1000 400mm TF-1 400mm FF 1121.2.2.4	5.0 5.0	69	S 1500 S 5500	1.15	1.15	59 918 8 5 8 3 6 3 6 3	https://www.wishinimit.com/products/assit/resembuse-assit-agua-wee-transmitter Proceed from enerald https://www.wishinibask.com/c-1297-plus-valves.assit
Column	Process-Mechanical Process-Mechanical	Dry Well Dry Well	CNV 1130,1160 Sewage Pump P-110.1, 2, 3, 4	2.0 4.0	69	\$ 160000 \$ 160000	1.15 1.15	1.15 1.15	\$2 645.0 \$846-400.0	https://www.usabluebook.com/t-searchresults.asp://kwdor/2ki/
Section Property	Process-Mechanical Process-Mechanical	Ory Well Ory Well	CV 1111,2,3,4 PV 120.1,2,3,4	4.0 5.0	63	\$ 20,000 \$ \$500	1.15	1.15	\$52 900.0 \$36 368.6	https://www.usablusb.ook.com/c-1297-plug-valves.arps
Column	Process-Mechanical Process-Mechanical Process-Mechanical		400 SCH 40 CS material	15.0 40.0		5 250000	100	100 100	\$350,000.0 \$0.0	tecludes fabrication and installation
According 14	Instrumentation Instrumentation	Ony Well Ony Well	PC/PT 1150 FE/PT 1160	1.0	ea ea	\$ 800 \$ 2600	1.15	115	\$1 058.0 \$2 428.5	https://www.instrumert.com/products/40544/resemount-4750w-magnetic-flow-meter
Angle	Process-Mechanical Plumbing	Outdoor Dry Well		1.0	es LS.		1.15	1.15	\$2 645.0 \$ 120,000	Estimated
March Marc	Plumbing Plumbing Plumbing	Odur Control Odur Control	oner page VVC Orain pipe CPVC FD	1						
April	HVAC HVAC	Ory Well Odur Control	FOA duct 55 FOA BV 2100	1.0	LS. ea	\$ 50,000	1.90	1.00	\$ 75,000	
Column	Instrumentation HVAC	Odur Control	FOAFF2150	1.0	e3 e3					
Column	HVAC HVAC HVAC	Odur Control Odur Control	FOA MO 2170 FOA MO 2170 FOA Mist Grosse Filter MS 2190	1.0 1.0	63 63					
Mary	HVAC HVAC	Odur Control Electrical	Odour Control System Here-Duall Carbon Advorption 600 mm fan	1.0	63	\$ 58,880 \$ 100,000	1.00 1.90	120 100	\$74 \$31.0 \$150 000.0	teclude start-up and Operator Training
Applied Part Part	HVAC	General Geotrical		1.0	E.S. 63					
March	HVAC HVAC		Some ten	1.0	63 63					
March Marc	HVAC HVAC	Wet Well Generator	1,000 mm fan 600 mm fan	1.0	63					
Description Control	Instrumentation Instrumentation	Seneral Seneral	Intrusion Marms Surge Protection Device	1.0	63	s 200	1.50	120	\$360.0 \$0.0	
Teacher Content	Instrumentation Snumeral	General Mar Wall	Templerature switch Smoke Detector Contrate Equipplising Sligh 600 Tell	5.0	63	5 40 5 1200	150	120	572.0	
March Marc	Structural	Dry well	Contrete Foundation Slab 600 THK	88.7	m'	\$ 1200	1.90	1.15		
March Marc	Structural	Generator	Contrete Foundation Slab 600 THK	\$7.9	m'	\$ 1200	1.90	1.15	S 119 800.34 S 85 014.90	
Section Control of the Control o	Structural	Mechanical	Contrete Foundation Slab 600 THK	16.6	m'	\$ 1200	1.90	1.15	\$ 34,428.24	
Design	Structural	Dry Well 2nd floor	Contrete Foundation Slab 300 THK	45.4	m'	\$ 1200	1.90	1.15	\$ 93,882.78	
Description Company	Structural	Staircase	Contrete Foundation Slab 600 THK	2.2	m'	\$ 1201	1.90	1.15	\$ 6625.38	
March Marc	Structural Structural	Wet Well Dry well	Concrete Walls W and E Concrete Walls N and S	167.2	m m	\$ 1500 \$ 1500	1.90	1.15	\$ 432,728.33 \$ 74,333.70	
Description	Structural	Dry Well 2nd floor	Concrete Walls N and S	21.7	- 0,	\$ 1500	1.90	1.15	\$ 56,076,30	
March Marc	Structural	Odour Control	Concrete Walls N and S	15.1	- 0,	\$ 1500	1.50	1.15	\$ 29 123.00	
Product Prod		Odour Control Mechanical	Concrete Walls N	7.6	m'		150	1.15	\$ 29,561.50	
Description Control Contro	Structural	Gectrical Room	Concrete Wall E	17.2	m'	S 1500	150	1.15	\$ 44,401.50	
Product Prod	Structural	Electrical Room	Concrete Walls W	4.2	m'	S 1500	1.90	1.15	\$ 12 420,00 \$ 10 967,50	
Property Property	Structural	Access Hallway	Concrete Centre Wall	5.5	m²		1.90	1.15	S 54 283.00 C C2.406.00	
The color of the	Structural Structural			25.5 1.0	m ³		1.90	1.15	\$ 65,925,36 \$ 29,320,00	Proceed from Granville Island PS
Additional Control C	Structural Structural	Ony Well	Sump Walls and Foundation 1.5ms2.5ms2m Somm RIP Sump Grating	7.8	m²	\$ 1500 \$ 207	150	1.15 1.15	\$ 20,066.06 \$ 890.88	
Additional Control C	Structural Structural	Ony Well Ony Well	Trench 290x200 Walls and Foundation Somm FRP Trench Grating	1.6 7.4	m'	S 207 S 207	1.00	1.15 1.15	\$ 288.85 \$ 1767.51	
Additional Control C	Architectural Architectural	Roof Roof	Concrete Roof 300 THK Green roof	156.6 522.0	, ,	\$ 1501 \$ 87	1.00	1.00	\$ 235 034.09 \$ \$2 221.10	Approximate for green roof over 2ply sits membrane roofing system
Additional Control C	Architectural Architectural	Ground Roor Ground Roor	External North Wall - Furring Strips Air Gap External North Wall - Grom Poly Vapour Barrier	2.92	m²	5 2	1.00	1.15	\$. \$ 179.51	SSMeans 06 16 36, 10 0800 SSMeans 06 16 36, 10 0800
Additional Control C	Architectural Architectural	Ground Roor Ground Roor	External North Wall - 75 mm Rigid Insulation External North Wall - 19 mm GIS Plywood painted	2.82	m² m²	S 22 S 29	100	1.15	\$ 214436 \$ 191855	ISMeans 06 22 10.24.0200 ISMeans 07 21 13.10.0440
Authors	Architectural Architectural	Ground Roor Ground Roor	External South Wall - Furring Strips Air Gap External South Wall - Gmm Poly Vapour Barrier	56.4 56.4	m²	5 2 5 2	1.00	1.15	\$ 194.58 \$ 167.38	SSMeans 05 16 36. 10 0800 SSMeans 05 15 36. 10 0800
Additional Control C	Architectural Architectural	Ground Roor Ground Roor	External South Wall - 75 mm Rigid Insulation External South Wall - 19 mm GIS Plywood painted	56.4 56.4	m²	5 29	1.00	1.15	\$ 2,068,56 \$ 1,850,81	65Means 06 16 36: 10 0000 65Means 06 22 10 26:0200
Activities 1	Architectural Architectural	Ground Roor Ground Door	External Cast Wall - Smm Poly Vapour Barrier Concred Cast Wall - 75 mm Bold Inv	121.1	m²	5 3	1.00	1.15	s 359.51	SSMeans 07 21 13 10.0440 SSMeans 07 (2 0 10.0000
Anthonic Section Control Con	Architectural Architectural	Ground Roor Ground Roor	External East Wall - 19 mm GS Plywood painted External West Wall - Furring Strips Air Gen	121.1 126.4	ar ar	5 29 5 3	1.00	1.15	\$ 3975.31 \$ 401.75	SCAMeans 05 16 26, 10 0000 SCAMeans 05 16 26, 10 0000
Activities 1	Architectural Architectural	Ground Roor Ground Roor	External West Wall - Emm Poly Vapour Barrier External West Wall - 75 mm Reid ing-Minn	116.4 116.4	, , , , , , , , , , , , , , , , , , ,	5 2 5 20	100	115	\$ 345.45 \$ 4.000**	SSMeans 04 22 10.24.0300 SSMeans 07 21 13.10.0440
Activities 1	Architectural Architectural	Ground Roor Wet Well	External West Wall - 19 mm GIS Plywood painted External North Wall - Water proof coating	116.4 76.4	m'	S 29 S 15	1.00	115	S 3819.76 S 1549.44	SSMeans 06 16 36: 10 0800
Activities 1	Architectural Architectural	Ory well Ory well	External North Wall - Furning Strips Air Gap External North Wall - Emm Poly Vapour Rarrier	46.2 46.2	m'	5 2 5 2	100	115	\$ 137.02 \$ 137.02	65Means 05 16 36 10 0800 65Means 05 16 36 10 0800
Activities 1	Architectural Architectural	Ory well Ory well	External North Wall - 75 mm Rigid insulation External North Wall - 19 mm GIS Phywood painted	46.2 46.2	m'	5 32 5 29	1.00	1.15 1.15	\$ 1693.36 \$ 1515.11	SSMeans 04 22 10.34.0300 SSMeans 07 21 13:10.0440
Activities 1	Architectural Architectural	Wet Well Dry well	External South Wall - Water proof coating External South Wall - Furning Strips Air Gap	76.4 46.2	-	5 15 5 2	120	1.15	\$ 1581.07 \$ 137.02	SSMeans 06 16 36, 10 0800
Activities 1	Architectural Architectural	Dry well Dry well	External South Wall - 6mm Poly Vapour Barrier External South Wall - 75 mm Rigid Insulation	46.2 46.2	m'	5 32	100 100	1.15 1.15	\$ 127.02 \$ 1693.36	SSMeans 05 15 36: 10 0800 SSMeans 05 15 36: 10 0800
According Control Co	Architectural Architectural	Wet Well	saternar south Wall - 19 mm GIS Plywood painted External East Wall - Water proof coating	46.2 200.3	8	9 29 5 15	120	115	5 1515.11 5 2076.62	Commence of 22 to 34.0000
Activities 1	Architectural Architectural	Ony well Ony well	External Sast Wall - Grons Poly Vapour Barrier	96.9		5 3	100	1.15	\$ 137.02 \$ 287.57	Onterent Up to an 10 MBD 65Means 07 21 13, 10,0449
Activities 1	Architectural Architectural	Dry well	Secretal Set Wall - /s mm legal insulation Secretal Set Wall - 19 mm GS Physiood painted	96.9	m'	5 29 5	100	1.15	3 3553.96 5 3179.86	CSM-sam: 06 16 36 10 0800
Activities 1	Architectural Architectural	Dry well	Eaternal West Wall - Furning Strips Air Gap Conserved West Wall - Comm Brok Vision - Province	96.9	m,	5 3	1.00	115	\$ 287.57 c	SSMeans 06 16 36 10 0800 SSMeans 06 22 10 34 0300
According Company Co	Architectural Architectural	Ory well One well	Saternal West Wall - 75 mm Rigid insulation Saternal West Wall - 19 mm GS Physical related	96.9 96.0	â	5 22 5 20	1.00	115	28/57 \$ 3553.96 \$ 3170~	SSMeans 07 21 13 10.040 SSMeans 07 12 13 10.000
April 1997 Apr	Architectural Architectural	Dry Well 2nd floor Dry Well 2nd floor	Interior Wall 5 - 19 mm GIS Plywood painted Interior Wall N - 19 mm GIS Plywood painted	68.0 22.4	m'	S 29 S 29	100	115	\$ 2231.48 \$ 1062.73	SSMeans 05 15 26: 10 0800 SSMeans 05 15 26: 10 0800
April 1997 Apr	Architectural Architectural	Odour Control	Interior Wall W - 19 mm GIS Plywood painted Interior Wall N - 19 mm GIS Plywood painted	68.0 24.0	a'	S 29 S 29	100	115	\$ 2231.48 \$ 797.50	SSMeans 05 15 3k, 10 0800 SSMeans 05 15 3k, 10 0800
April 1997 Apr	Architectural Architectural	Wechanical Wechanical	Interior Wall N - 19 mm GIS Plywood painted Interior Wall W - 19 mm GIS Plywood painted	48.0 12.0		S 29 S 29	100	1.15	\$ 1575.16 \$ 293.79	SSMeans 06 16 36, 10 0800 SSMeans 06 16 36, 10 0800
ADMINISTRATION Consideration Considerati	Architectural Architectural	Mechanical Electrical	Interior Wall 5 - 19 mm GIS Plywood painted	48.0 48.0	m² m²	\$ 29 \$ 29	100	115	\$ 1575.16 \$ 1575.16	SSMeans 06 16 36, 10 0800
Additional Sect Sept (2017)	Architectural Architectural	Electrical Access Hallway	Interior Wall W - 19 mm GS Plywood painted Interior Wall Centre - 19 mm GS Plywood painted	64.0 92.2	m²	5 29 5 29	1.00 1.00	1.15	\$ 2100.21 \$ 3023.98	SMeans 05 16 36, 10 0800 SMeans 05 16 36, 10 0800
Michael Sept Opp Ort	Architectural Architectural	Access Hallway Access Hallway	Interior Wall 5 - 19 mm GIS Plywood painted Interior Wall N - 19 mm GIS Plywood painted	23.2 23.2	m²	5 29 5 29	100 100	1.15	\$ 1089.49 \$ 1089.49	SMeans 05 15 36: 10 0800 SMeans 05 15 36: 10 0800
Michael Sept Opp Ort	Architectural Architectural	Access Hallway Generator	interior Wall 5 - 19 mm GS Plywood painted Interior Wall 5 - 19 mm GS Plywood painted	14.0 42.5	m² m²	, 29 5 29	1.00	1.15	5 459.42 5 1393.49	Conference us to as. 10 0800 65M-ream 05 16 36, 10 0800
Additional Sect Sept (2017)	Architectural Architectural	Venerator Washroom	Interior Wall N - 19 mm GS Plywood painted Interior Wall N - 19 mm GS Plywood painted	22.0 24.0	m²	5 29	1.00	1.15	5 1050.11 5 787.58	Contracts to 14 at, 10 0800 65M-sent 65 15 25 10 0800
Michael Sept Opp Ort	Architectural Architectural	Washroom Wet Well General	Interior wans - 19 mm GG Plywood painted Epoxy Costing Inner wall Boof Insulation	247.4	m²	5 3	1.00	1.15	5 787.58 5 1046.91	Commons to to as to time to the confinence of th
April Apri	Architectural Architectural	Onywall 2nd Floor General	Glaring Single Doors	7.0	LS. ea	S 20 000 S 424	100	100 115	\$ 4094.87	https://www.cdhdintribustors.com/commercial-steel-do.ors/
Account Section Sect	Architectural Architectural	General Odour Control	Exterior, weather groof Double Doors Exterior, weather groof Double Doors	1.0	63	\$ 2070 \$ 2070	100	1.15 1.15	\$ 2 280.50 \$ 2 280.50	SSMeans 08 11 16 10 0000 SSMeans 08 11 16 10 0000
Section General Milkeling Section No.	Architectural Architectural	General Seneral Dry Well 2nd Dry	Interior double doors to Electrical Stains Sloor Matrix	1.0	ES.	\$ 25000	120 100	1.15 1.00	\$ 1184.87 \$	https://www.cdfdistributors.com/commercial-steel-doors/
	Electrical General	General	NI Building Electrical Commissioning (2%)	0.02	LS. %	S 2772245 S 15981179	100	100	\$ 2772 264.75 \$ 329 627 A4	
General Secrety [25] 0.03 S. 5 559172 5 29542346 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6 6	General General		Warranty (2%) Size Office / Admin Costs	0.02 180.00	% day	\$ 15 981 172 \$ 800			\$ 329 623.44 \$ 144 000.00	
	General General	l	Insurance & Bond Mobilization and Demobilization Costs	0.02	% %	\$ 15 981 172 \$ 15 981 172 Gup ****	Cult Vision		\$ 329.623.44 \$ 429.435.16	
General Mobilization and Demobilization Cents 0.03 N 5 15581127 5 (274 CES L)	1					PSTTax	7% TOTAL		5 1229 443.43 5 18 792 404	



Cost Estimating Summary

- Costs derived from
 - Analogy to other projects
 - Cost models (i.e. flow vs cost)
 - Unit rates (costs per meter)
- Relative ranking of costs
 - Comparison between options
- Must be refined as the Project advances



Hydraulics in Pumped Systems

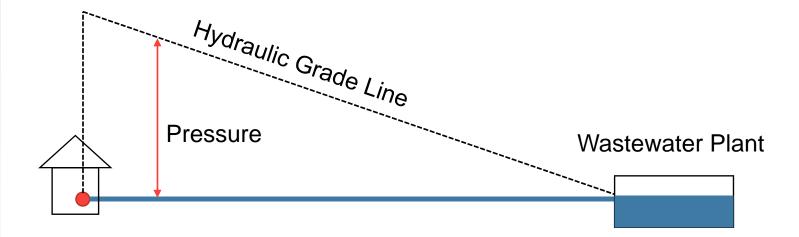


Hydraulics in Pumped Systems

- Keys Words
 - Forcemain a pressurized sewage pipe
 - Gravity main a non-pressurized pipe open to the atmosphere (typically at manholes)
- Hydraulic Grade Line (HGL)
 - Hydraulic grade is the static energy in a pipe system, including the sum of pressure and elevation
- Energy Grade
 - Similar to HGL but includes kinetic energy (velocity).
 Generally minor in water/wastewater systems.
- > In gravity mains:
 - Pressure = 0



Hydraulics in Pumped Systems





For meeting # 6...

Thursday March 21, 9-12

For each component;

- Review conceptual studies of Long List options
- Evaluate
- Settle on the Short List for detailed study



Round Table

[Allison]



Thank You!

