First In The Field —
The Pioneer Years of Garden, Hermon and Burwell

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THE POWER BUSINESS – PART 1

In the early 1900's, the use of water generated almost as many kilowatts of political power politics as it did of electrical energy.

Till 1890 the resource had been used for domestic supply, placer-mining and irrigation — a necessary commodity, and administered as such. But its prospective use for hydro-electric power was to bring even more speculation than was apparent in the other natural resources — and consequent political finagling.

However, the wrangling and wheeler-dealing which surrounded the advent of the Coquitlam/Trout Lake power development will be dealt with more fully later on. In this chapter the doings of politicians and board room sitters, while not being downplayed in importance, will take second place to the activities of those who (from this writer's point of view) were truly the central figures in B.C.'s first mega-project; namely Johannes Buntzen, and engineers Meredith, Hermon and Burwell. Greater Vancouver was about to get its first hydro-electric power station.

Coquitlam Lake lay in the area set aside for administration by the Federal Government — the Railway Belt. It is some six miles north of Port Moody, where it drains a mountain watershed of approximately 100 square miles. The average annual precipitation in 1903 was thought to be 150 inches — a close approximation (today the figure given is 145 inches). What was known for sure was that it was wet, as all workers on the power project would soon be able to confirm.

One of the earliest men to explore this valley was Col. John Vicars D.L.S., whose survey of the perimeter of the lake was signed in the *Department of the Interior* in Ottawa on March 2nd, 1890. The work was probably done in late 1889. Coquitlam Lake lying as it did in the Railway Belt, the sections and ranges of the Dominion government survey system covered it, as well as the whole area easterly from the Indian Arm of Burrard Inlet and north for at least another six miles. While most of this grid would only be surveyed on the ground in part, where occupation or development made it necessary, it was plotted and projected over the official map, where it provided a legal handle for administrative purposes.

Not all of these north/south/east/west lines were theoretical. One line in particular — the north boundary of Township 39, E.C.M. — had been surveyed on the ground; by the B.C. Government shortly after Confederation. This was the line to which Col. Vicars had referred his survey of Lake Coquitlam. It crossed from east to west about half a mile south of the lake, bisected Trout Lake, and so down to the Indian Arm. Prior to 1897/8, this was the only apparent surveyed line in the general area, although "apparent" is probably the wrong word — after twenty years of unchecked growth in the bush.

Trout Lake sat in a pocket in the mountains above Indian Arm, west and a little south of Coquitlam Lake, but with a 4000-ft high range of mountains between the two lakes. In the very early days of Vancouver it had been named Lake Beautiful, by a group of

hikers, who, by taking one initial from each of the girls' names in the party, formed the word BEAUTIFUL, It was then, and is now, a very beautiful lake; although in the years from 1902 until 1912, when construction was rampant, I doubt if it would have qualified for the name.

Before Col. Vicars made his exploration in the valley, the *Coquitlam Waterworks Co. Ltd.* had been incorporated by statute in 1886. A.J. Hill C.E., a well-known engineer & surveyor, later active in municipal affairs, was one of the directors of the company. After being an unsuccessful candidate for Vancouver's water supply, the company had carried on supplying *New Westminster City*, who in 1889 took over all their interests, and contracted to manage the waterworks. Thenceforth it would be known as the *New Westminster Waterworks*. It consisted of a low weir and intake, *"500 feet downstream from the first riffle in the river, where it gets over the rim of the lake"*. There was a second intake lower down, to draw water when the stream was low; and from the inlets, a 14" pipe ran south for 12 miles. The consulting engineer for the *New Westminster Waterworks* was Mr. A. McL. Hawkes, C.E., of Tacoma, Washington, an experienced and reliable man, who so described the workings in December 1901.

So, to recapitulate what has taken several pages to relate — the year 1897 found this wet watershed in much the same circumstances as it had been 100 years before, with few legal dispositions of any of the land, a timber/rock-fill dam at the end of the lake, and a certain amount of logging in the more accessible places.

Timber Berth "O" was granted in that year, most of it in the vicinity of Trout Lake, and held by the *B.C. Mills, Timber and Trading Co.* (successors to the Hastings Mill) — This Timber Berth was bought out and assigned to *Vancouver Power Co.* in August 1902. The company also acquired T.B. 299 soon after. Their surveyor was E.B. Hermon. This was without doubt *Hermon & Burwell's* first introduction to the area, and they were not tardy in realizing its potential.

When the *B.C. Electric Railway Company* arose — phoenix-like — from the ashes of three earlier tramway companies in 1897, its policy had been for the board of directors in Britain (of whom R.M. Home-Payne was the leading light) to control operations through a local manager in Vancouver. The first such manager was F.S. Barnard, who incorporated the *Vancouver Power Company* as a subsidiary, although the move had not been sanctioned by the Board.

The next manager was Johannes Buntzen, a very dynamic and level-headed man. He was a Dane who emigrated to British Columbia in the 1890's, working at first for *Ross & Ceperley* as head book-keeper. As general manager of the *B.C. Electric Railway Co.*, Buntzen was both forward-looking and forthright, and quite prepared to push the Board into major decisions; he soon made his point — that the company must keep up with the demand for power, or be content to face competition.

He was absolutely right. The *Stave Lake Power Co. Ltd.* would be incorporated in 1901, for the purpose of selling power to the cities of Vancouver and New Westminster. That company's directors included several influential persons, amongst them Sir Charles Tupper K.C. Stave Lake and Stave Falls (the proposed site of the project) were also in the Railway Belt, and after the company had been granted 75,000 miner's inches on the Stave River by the B.C. government, they were far-sighted enough to apply for, and obtain, a quit-claim of the Dominion government rights in the matter. Which put them legally

beyond the starting gate. But, without adequate financing, they never got to the first hurdle. For the next ten years they would lose no opportunity in harassing their rival, the *B.C. Electric Railway Co.* Johannes Buntzen and the Board, who could only guess at the Stave Lake Company's finances, were concerned.

As consultants for the *Vancouver Power Company*, Hermon & Burwell were investigating the Lake Coquitlam area in 1898. One field-book — badly water damaged — shows their first measurement of river flow below the New Westminster Waterworks pipe intake, of 26,000 miner's inches, taken February 3rd, 1898. Hermon went on to measure the flow monthly during that year, and in July ran a line of levels down the river from Coquitlam Lake, setting twenty-six bench marks. From this preliminary evolved the first scheme of development, which would entail a dam at the lake outlet, a long ditch and flume, with power-house at Port Moody. This scheme was not pursued, and whatever the reasons for not pursuing it, hindsight shows that the decision was wise.

At this juncture I should mention — without explaining in detail — the phenomenon known to engineers as "differential levelling". It is a procedure that surveyors have been using for hundreds of years to measure differences of elevation, and since all civil engineering projects are based on such differences, levelling becomes a way of life for the profession. Required are a levelling instrument (a spirit level), a graduated rod, and two men having feet that are not too flat, one of whom (the one who stands behind the instrument) having the ability to add and subtract. This small crew of two can travel for miles, moving one at a time when not taking sights, setting intermediate marks known as "turning points", or more ornate marks called "Bench Marks", in order to ascertain the required differences in height. So far no-one has come up with a better way; and it is basic in civil engineering.

One of the hazards of surveying in British Columbia's coastal district is, of course, the rain. So not only would a good level man need to be (a) dedicated to maintaining precision, but also (b) willing and eager to work through the wet bush, peer through the wet lenses of his instrument (which he would dry off from time to time with small pieces of tissue paper), and write down the results in his (wet) field-book. Some might consider that a trait such as (b) could be a sign of a weak mind; but it certainly was a necessary quality on those early engineering projects.

Nowadays, Bench Marks in built-up areas are legion, and even in remote places a person never has to go very far to find a point of known elevation. But in 1901 finding differences of elevation had to be done from scratch, and any B.M.s set were carefully preserved for the surveyor's own reference. The Lake Buntzen brochure, issued after construction tells of twenty miles of levels run.

To obtain the difference in elevation between Trout Lake and Coquitlam Lake was no mean feat at that time. *Hermon & Burwell* started their network at the Barnet wharf where they set-up a tide gauge, and connected their elevations to a C.P.R. datum point near the Coquitlam railway bridge. Lake Coquitlam's height above sea-level was then obtained by another 7 miles of differential levels from the bridge up to the lake outlet. (This line of levels was rerun in both directions to absolute precision in March 1902, before the final decision was made to construct).

The elevation of Trout Lake was somewhat easier to arrive at, by measuring up from tidewater. Burwell set-up a tide-gauge down in the Indian Arm, with a B.M. and water

gauge in Trout Lake; and by correlating the tide-gauges with the C.P.R datum, and their own many miles of levels, the partners determined the relative difference in height between the two lakes. So the project was born.

This was — briefly — to put a low dam at the Coquitlam Lake outlet (increasing the head, and improving the intake for the *New Westminster Waterworks*); tunnel through the mountain, diverting Coquitlam Lake water into Trout Lake (which would also be dammed as a balancing reservoir), and run pipelines down to a power-house on the Indian Arm. The power would go via pole-line to New Westminster and Vancouver; a well-devised scheme.

It goes without saying that the rights of the *Waterworks Company* would have to be safeguarded, so Buntzen went to work on New Westminster City Council, pointing out the blessings that would accrue from *Vancouver Power Co.'s* aspirations. In mid-October 1901, A. McL. Hawkes made his report to the City, coming out in favour of the enterprise, and saying in part: *"... In my judgement ... the construction of a dam would be a benefit to the City's water soppy and if the work could be carried-out without any expense to the City, I would recommend it."*

In the report he made certain stipulations, such as: that the dam should be five feet high (ten feet was eventually agreed to); the intake should be extended beyond the dam; and that the lowest level of the diversion tunnel be six inches higher than the intake pipe; all of which *Vancouver Power Co.* were quite willing to implement, and at their expense.

Enough engineering data was now available for Buntzen to start action. He also had the backing of his Board in London. So after getting at least tentative agreement from the City Council on October 18th, 1901, he was ready for the next — very important — step.

This was, of course, to obtain a water-record. Applications were made by the *Vancouver Power Co.* under the *B.C. Water Clauses Consolidation Act* on August 23rd, and September 30th, 1901, for 5000 miner's inches of water from Lake Coquitlam, and 500 inches from Trout Lake. The repercussions were considerable.

At this point I have to leave the surveyors, doggedly working in the pouring rain, in order to describe briefly the devious route followed by these applications.

Johannes Buntzen was a man well aware of the powers of political persuasion, as indeed were all the directors of the *B.C.E.R.Co.* No sooner had the water records been staked, than the Hon. W.C. Wells, *Chief Commissioner of Lands & Works* received Buntzen's detailed letter. It was an excellent letter, and attended to the only two really relevant points: first that the *City of New Westminster* (the only prior interest) had agreed to the power company's proposals, and secondly that the money was all there and ready to be used (subject to the granting of the 5000 and 500 miner's inches of water to *Vancouver Power Co.* as the sole licensee).

By this time, the *Stave Lake Power Co.* had become aware of such happenings, and also made application for a water record on the lake (of 10,000 miner's inches); and if there was any question of the *Provincial Water-Recorder* using his own discretion in adjudicating the matter, it was promptly overruled by his superiors in the *Lands & Works Ministry*. In fact, by October 23rd, the *Water Recorder* noted that three other Municipalities had also joined New Westminster in applying for water rights — Delta, Richmond and

Coquitlam. He also reported that “opposition was developing”.

Opposition was a fairly mild word to describe the bickering that took place at the subsequent enquiry in which both E.B. Hermon and A. McL. Hawkes gave their expert opinions; but at least all parties had a chance to sound-off. It seemed that if the object of the *Stave Lake Company* was simply to delay proceedings, it was succeeding.

Buntzen then sent another letter, this time to the Provincial Secretary, November 9th, 1901, protesting the *Stave Lake Company’s* delaying tactics. Altogether, governmental deliberations dragged on from September 19th until December 4th of 1901.

In fact the cabinet had little alternative but to grant the *Vancouver Power Company’s* application. The company had priority of staking (for what that was worth!), there was plenty of water, the money was in the bank, and the power was necessary for future of the Lower Mainland. A.E McPhillips K.C. (who, as a director of the *Vancouver Power Company*, was handling all their legal business) put the matter succinctly in another letter to the Provincial Secretary, on 27 November 1901: *“It is apparent that the time has come for the Lt. Governor-in-Council to act in the matter, to prevent retarding of actual construction of a large work which will be of great public advantage.”*

So the first battle was won. The spoils — 5000 miner’s inches of water from Lake Coquitlam, and all the water in Trout Lake, issued to the *Vancouver Power Company* by the Lt. Governor-in-Council (i.e. the Cabinet) on December 4th, 1901. This was, of course, only half of the war, the Provincial half. The other half would be waged with the Dominion government, who had hardly started to flex their muscles yet; it would drag on much longer.

Buntzen would continue to report regularly to Horne-Payne in England regarding events, and big decisions would always be made by the Board. Although the engineering reports were thus far favourable, there was a lot of money at stake. Two more eminent engineers visited the site in early 1902, and made their reports; Wynn Meredith of the firm of *Hunt & Meredith*, and Robert F. Dobie were both from San Francisco. The report of a third engineer, Hugh L. Cooper of New York, was made as late as July 1902, and served merely as corroboration, as by that time construction was under way.

Part of Buntzen’s letter to Home-Payne of March 14th, 1902, is quoted: *“...before any of the engineers would give their final definite opinion, they insisted on having the respective elevations of Coquitlam Lake and Trout Lake determined with absolute accuracy ... yesterday morning at last Mr. Hermon succeeded after two weeks of great hardship, in finally determining the elevation, and I am glad to say, found it better than we had expected, the difference in altitude being that Coquitlam Lake is 32 feet higher than Trout Lake, making a splendid grade for a tunnel…”*

During the fall of 1901, *Hermon & Burwell* carried on with the mass of preliminary work required. The complete layout plan (showing lands required, tunnel, dam sites, power-house site) is dated November 28th, 1901, and still has the provisional elevation for Lake Coquitlam shown, although the plan of December 28th, 1901, shows this elevation correctly, as 432 feet above sea level. As early as September 1901, the firm had made application on behalf of the *Vancouver Power Company* to the *Dominion Land Agent* for the Crown (Dominion) Land

required; they would make the necessary ground surveys for these parcels of land in March of 1903.

It has been said that descriptions of land within the Railway Belt are only understandable by surveyors. If I were rash enough to describe legally the parcels for which this application was made, I would be proving this statement beyond all doubt; and I would also be losing the reader (most people's eyes start to glaze over when confronted with an expression such as LS 2 & E ½ 3, S 5. Tp 5. R 6. W of 7th) — This would translate into: "Legal Subdivisions 2 & East Half of 3, Section 5, Township 5, Range 6, West of the 7th Meridian." There is only one parcel of land in the whole of Canada to which this could apply, and it is the parcel which was in dispute.

So I will simply say that the parcels of land covered all the necessary parts of the project, as did the *rights-of-way*, and that all could be straightforwardly approved (and were), except one. This was the parcel at the end of Lake Coquitlam which covered the proposed darn and new intake for the *New Westminster Waterworks*. The application for this parcel bore the words "if not already disposed of". Nevertheless, there would be much controversy over this. If at some future date the *Vancouver Power Co.* wanted to raise the dam, they needed control, and they were determined to get it.

On December 10th, 1901, Buntzen writes of taking all necessary data, surveys, plans and measurements furnished by *Hermon & Burwell* to Toronto, to prove to the prospective debenture holders the feasibility of the scheme. The formal application for approval under the *Water Clauses Consolidation Act* was made by A.E. McPhillips on January 10th, 1892, and included a mass of plans, specifications and complete data provided by the firm.

The next step was the selection by the London Board of a Chief Engineer. There were four applicants, amongst them Wynn Meredith and A. McL. Hawks. The job was offered to Wynn Meredith in a long letter from Buntzen, April 30th, 1902. It said in part: *"...as you are no doubt aware, the power scheme originated with Messrs Hermon & Burwell of this city, and so far all the preliminary work has been done by this firm, and we feel in duty bound to give them a substantial share of the engineering in connection with the development of the scheme..."*

Perhaps the most unusual aspect of this whole power development by the *B.C. Electric Railway Co.* is the fact that most of the work would be accomplished by "day labour under the direct supervision of the Company's engineers". Only the tunnel, construction of the steel pipes, and some land clearing was done under contract. "The Company's engineers", however, would need to cover several different spheres of expertise.

The firm of *Hunt & Meredith*, of whom Wynn Meredith was chief engineer of the project, were mechanical engineers specializing in hydro-electric design, and besides having had sole control of the Los Angeles system some years before, had handled the *B.C.E.R.Co.'s* first project, the plant at Goldstream, Vancouver Island. The *B.C.E.R.Co.* itself — in particular R.H. Sperling — would obviously provide the expertise in electrical matters. E.B. Hermon and H.M. Burwell were both civil engineers of considerable experience, and E.B. Hermon was a graduate in mining engineering.

J.W. Hermon, writing in 1938, mentions that the scheme was "conceived and carried-out"

by *Hermon & Burwell*, as engineers-in-charge. This is true. That it was conceived by them cannot be doubted, as witness the field-books of 1898 to 1901. Add to this fact that the lion's share of work on the project was plain, downright, civil and mining engineering, with a lot of surveying Burwell taking charge of dam and power-house, Hermon looking after tunnel and transmission lines.

In May of 1902, Wynn Meredith arrived in Vancouver, setting-up his office alongside that of *Hermon & Burwell* in the *Inns of Court* building. There can be little doubt that their overall ideas were in agreement, the proof being that Meredith's estimate of 18 months to production of the first power was entirely accurate.

Field surveying up to this point had been preliminary in nature; now the detailed surveys necessary for engineering design (required immediately), and also for construction control would start. First and foremost was alignment of the tunnel for which both east and west portals had already been selected. It would cross beneath the ridge approximately 6½ miles north of Eagle Mountain.

The partners cooperated on this tough assignment, running a trial line to the top of the ridge from the Trout Lake end, and producing it to the east shore of Coquitlam Lake. A minimum of clearing was done on this line, distances from each end to the top of the ridge being computed by triangulation to close-by "Tunnel Mountain" (so named in the notes). From the trial line, the portals at each end were tied in. After which, the true line from portal to portal was cut out over the top of the mountain, and precisely aligned. The field-notes show that this work took six days; the partners must have had two things going for them — good weather, and big crews, because even with modern instruments it would be hard to do it in less time.

Clearing contracts, and the road to the Coquitlam dam and tunnel portal were E.B. Hermon's first concern; after which his responsibilities were for the Coquitlam Lake dam, which would be a rock-fill and timber structure, and the tunnel itself.

The tunnel was designed with a slight change of grade at the half-way point, to facilitate drainage, which is always a problem underground. Maintaining alignment was no problem; on the west shore of Trout Lake, and on the east shore of Coquitlam Lake were alignment flags (the latter being on what is today called Coquitlam Island — an island that came into being by subsequent raising of the lake to present-day levels.

Surveying parlance underground has its own language, for instance, the roof of the tunnel is known as "the back", and in it survey marks known as "spads" are set for controlling alignment and grade; they usually stay there unmoved, apart from the one nearest the face, which might get hit by a flying rock. When tunneling, the sequence of events is simple — the miners drill and blast; followed by the muckers who clear up the mess, ready for the miners again. In between shifts, the engineer has to get in to set alignment and grade; he usually does it after the muckers have finished, although miners working on contract often resent the time taken, and are not averse to throwing rocks at him, to hurry up the process.

The Coquitlam tunnel was no different from other tunnels, but there were no modern conveniences such as mucking machines — just a lot of men with

shovels filling up the hand-cars to push back out to the portal; and all workers used carbide lamps — a temperamental device which often went out at the crucial moment, such as when a surveyor was in the process of taking a sight. Special underground words were sure to be used on this occasion also.

So much for that first tunnel from lake to lake. It was started in January 1903, driven from both ends. The contract was given to *Ironside, Rannie & Campbell*, who employed over 175 men, and sometimes as many as 300 on the job, probably housed at J.J. Nickson's camp. They worked in 8 hour shifts — days, nights and holidays. In April 1905, the two ends met in traditional fashion, with a closing error of 7/8 " in alignment, and 1¾" in grade.

H.M. Burwell undertook the work for the power-house site, the Trout Lake dam and the pipe-lines (penstocks). The dam was an engineering project in its own right, as drilling had to be done to bedrock, and then the entire overburden removed — some 20,000 yards — before the forms could be set. On June 20th, 1902, Burwell set the marks for the bedrock shafts, and on the same date ran trial lines for the penstocks. June 21st found him cross-sectioning the power-house site at tidewater. Early in July he started on the transmission line right-of-way, from power-house going south to a crossing of Burrard Inlet at the narrows (Burn's Point), which involved more triangulation. When built, these structures presented *"a notable feature ... near the village of Barnet".* (The *Vancouver Power Co. Ltd.* brochure, c.1905.)

Excavation methods used by Burwell at the damsite would certainly be frowned upon today (he washed the overburden down the creek by hydraulic means) — but it certainly saved a lot of manual labour. As did the tramline which he designed from tidewater to Trout Lake. This was essential for bringing up material, cement for the dam and pipes for the west tunnel portal. As time progressed through 1903, Burwell was responsible for installation of the four 1500 kw generating units in the power-house. The plant would produce a total of 6000 kw.

The *Vancouver Power Co.'s* brochure gives credit to three men in particular for this undertaking: Mr. J. Buntzen, general manager of the *B.C.E.R.Co.*, Mr. R.H. Sperling, advising electrical engineer, and Mr. R.M. Home-Payne, the chairman of the *B.C.E.R.Co.*; and in the last paragraph it names the engineers: Mr. Wynn Meredith, of San Francisco, chief engineer for the Company, and Messrs Hermon & Burwell of Vancouver, engineers in charge of construction.

It was without doubt a successful and efficient undertaking. Power from the project was being received in Vancouver by December 1903, and in December 1904 the *B.C.E.R.Co.'s* old steam plant closed except for emergencies.

It is interesting to quote some of the April 1905 statistics. The Coquitlam Lake dam was 10 feet high. The tunnel was 9 feet square and 12,775 feet long. The Trout Lake dam was 54 feet high. But no engineering work remains static; it is always being improved upon. By the time the original specifications had been carried-out, plans had already been made to raise the Coquitlam Lake dam and enlarge the tunnel. Today the lake level is at least 70 feet higher than in 1902.

Nearly all these improvements would be made after Johannes Buntzen had left British Columbia. He has been called the "grand-daddy of electricity in British

Columbia", a label well-earned. His services to the *B.C.E.R.Co.* were recognized in April 1905, when he became managing-director of the company. By all accounts he was a modest and fairly retiring man. On the other hand, there was no doubt as to his popularity in the city and throughout the whole company as well, to the extent that he was even made an honorary member of the *International Brotherhood of Street Railway Employees*. There would be no labour troubles while he was at the helm. He was, during his time in Vancouver, a strong supporter of the arts, in music and literature, although this is less well-known; and even had time to sit on a *Royal Commission on Taxation* in 1905, together with F. Carter-Cotton, R.G. Tatlow and D.R. Kerr — all political gentlemen. But then Buntzen himself was also a political animal, and without his flair for politics, his hydro-electric venture might have had a rougher passage.

At first he chose to leave Vancouver to live in London, England, for nine months of the year. But in 1906 he moved back to his native Copenhagen, visiting Vancouver less frequently until his death in 1922.

Herman & Burwell continued until 1906 as consultants for the *Vancouver Power Co.* One of their last letters in that capacity was seven pages long, and has to do with maintenance on the Coquitlam dam. In 1908, as a preliminary to raising the level of the dam, they surveyed the perimeter of the area to be flooded. They were also asked to supervise construction when the tunnel was enlarged, and laid the necessary double-track. However, finding that they would not be able to complete the job in the time allotted they resigned at the end of two months. (*Hermon & Burwell* recommended that with a mechanical mucking device, 30 feet per day could be accomplished — R.H.Sperling's diary, February 25th, 1909.) They had no lack of other work from that generous client, the *B.C.E.R.Co.Ltd.*

There are still 15 other Trout Lakes in British Columbia, according to the *Gazetteer*. Johannes Buntzen could not have received better recognition for his services, than to have this one named after him. From a small beginning the Lake Buntzen hydro-electric development was not slow to grow; even by 1911 it was producing 15,000 kw. It now boasts two power stations and an output of over twelve times its original output. And the lake is still as beautiful as it originally was.