NAWAPA XXI: Great Project To Restore the American System

In a recent discussion, Lyndon LaRouche identified NAWAPA (the North American Water and Power Alliance) as "the greatest project ever attempted by mankind." Not only will it bring a "full revival of the industrial and related potential of the U.S. economy," LaRouche said, "It would also be a major focus of cooperation with other nations.... With the combination of a space program, that is, the restoration of NASA, for example, and the development of NAWAPA, these two factors as the key factors in the U.S. economy, will ensure a general, early recovery of the United States economy, and will provide a system for the future of mankind, going into some centuries to come."

In our March 30 issue, we published a significant portion of the NAWAPA XXI report, issued by LaRouchePAC in March. This week, we follow up with Sections I and II.

Section I: System Requirements

Part 1: Estimation of Resources Required

Phase 1 – General Organization

The following description of the phases involved will be expanded in the Second Edition of this report.

An approximate re-derivation of the original estimates on employment of 4 million jobs must be performed for the description and tables included in this section. In addition to the jobs related to the NAWAPA XXI system itself, employment will be calculated for the new industries and infrastructure, needed to generate and supply those requirements.

Skilled personnel will be needed to translate the following calculations of the required tons of steel, aluminum, millions of cubic yards of earth and concrete, etc., into approximate numbers of manufacturing and labor employment that would be created. The authors of this report are putting out a call to those persons to use the following preliminary analysis to complete employment calculations.

1. Administration

a. Management Teams. It is presumed, based on historical organizational structures, that a special joint NAWAPA XXI authority would be assigned, comprised of officials from the three participating nations, the United States, Canada, and Mexico, to preside over the administration of the project.

b. Control Systems. A central control base will be established in a strategic location, probably Idaho, where all primary management teams and staff would be housed. This will be where the main communications, information management and security systems would be maintained and operated. All primary finance and accounting and contract administration departments will reside and operate here.

The hardware and software needed for information management and security systems, and to manage all direct and indirect pre-construction, supply chain, and construction activities involved, will be of the highest sophistication, vast and integrated, most likely stretching the limits of existing technology and requiring innovations. The implementation of these control systems alone will employ hundreds of highly technical people.

This control center will be the platform for directing all activities. Other satellite bases will be established at each of the construction sites and will link to the central control base. All data will be processed and used as input to the master real-time construction schedule, constantly identifying activities that need attention within the multitudes of critical and semi-critical activity paths occurring simultaneously. These control systems will be among the crowning achievements of the entire operation. More will be described concerning the special role of the investment division of this control center in Part 3 of this Section.

2. Geophysical Survey

In order to gather data on physical conditions which determine design parameters for the construction of tunnels, dams, canals, and other project considerations, an array of scientific analyses must be carried out.

a. Topographical. For updated spatial mapping of potential routes, surveyors, cartographers, and photogrammetrists, will be needed to analyze the collected data, along with the surveying and mapping technicians assisting them. Ground, aerial, and satellite imaging (GIS) will be employed.

b. Geotechnical. For all aspects of project planning, engineering (such as dam placement), and related prospecting made possible, various subcategories of professional disciplines related to geological sciences will be needed, including soil scientists, mineralogists, vulcanologists, limnologists, seismologists, hydrologists, deep aquifer specialists, and deep-seated foundation geologists.

c. Environmental. Among the specialties needed will include, but not be limited to the following: Oceanographers will be needed in forecasting the effects and quantities of altered salinity levels related to reduced ocean runoff. Biologists will study effects on plant and animal life and direct relocation programs if necessary. Foresters will direct the harvesting of millions of board feet of lumber that can be used in the construction of base camps and general construction. Hydrologists and civil engineers will be needed to manage erosion control during construction.

3. Structures, Systems, and Component Design

Every aspect and component of NAWAPA XXI will require design and documentation, i.e., all the necessary plans for manufacturing and construction. The following is a broad overview of just some of those disciplines, and central to those will be thousands of draftsmen drawing plans and noting specifications using sophisticated, interactive CAD (Computer Aided Design) systems. Supporting all aspects of NAWAPA XXI's multifaceted processes will be thousands of administrative people and their related communications and information-management systems.

a. Structures. Dams, Reservoirs, Tunnels, Pipelines, Aqueducts, and Canals. Civil, structural, dam, highway engineers, and engineers specializing in cold-weather construction. Explosive, electrical, and mechanical engineers.

b. Hydroelectric Power Plants and Pumping Systems. Penstock specialty and high-head power generation, electrical, mechanical engineers.

c. Nuclear Power Plants. Nuclear and chemical engineers, structural, mechanical, electrical materials, and all other related disciplines.

d. Power Transmission Lines. Electrical, mechanical, civil, and structural engineers.

e. Maglev Trains and Railways and Roadways. Rail, electrical, mechanical, and civil engineers.

f. Materials Production. Chemical engineers, metallurgists, foundry and forging specialists.

g. Machinery Production. Mechanical engineers, materials science, metallurgy, quality control, and quality assurance.

h. Resource Mining. All geological and mining related disciplines, civil, structural, mechanical, and electrical.

Phase 2 – Preconstruction

1. Land Acquisition & Allocation

a. Boundary Surveys. Much of the data required to define areas occupied by physical components of the system and their access easements will have been gathered during the topographical surveys. However, actual boundaries will need to be defined and platted for legal entitlements. Surveying engineers and draftsman will be needed.

b. Access Easements. In practically every case, each component in the system will require a new access easement that will require surveying and mapping.

c. Legal Entitlements. The entitlement process will require attorneys, title agents, appraisers, and related staff people. In some situations, private property will need to be acquired with eminent domain mechanisms and fair compensation.

d. Relocation. In certain circumstances where people are living within the boundaries of project areas, relocation will be required. Appraisers, surveyors, attorneys, title companies, and real-estate agents will be involved.

2. Access Construction

a. Roadways and Railways. Each component of the project will require the construction of a new access route typically extending from existing routes. This will require many of the engineers and trades used to construct each project component. The complete array of civil and geophysical engineers will be required to design routes that overcome physical challenges. Operating engineers will be central to the construction process.

b. Bridges and Tunnels. Civil and structural engineers, and many of the construction crafts will be involved—form setters, iron workers, welders, concrete workers, electricians, and heavy equipment maintenance personnel. Crane operators and heavy equipment operators will be critical.

c. Utilities. In certain cases, it may be possible to extend available utility lines to project sites, or for temporary use, to construct base camps. However, in most situations, some type of new power generating system will need to be built on site. Smaller scale modular nuclear units would be the most desirable. Those who work with high-powered electric machinery, i.e., 13.8KV motors and switch gear, 500KV substations and transmission lines, will be at a premium, such as linemen, substation crews, power generation crews, and those working with switchgear and transformers for electrical equipment, along with transmission lines.

3. Material Production Systems

a. Natural Resource Mining. Limestone mines, new rock quarries, and crushing facilities will be in operation at most sites where concrete is to be poured.

b. Cement Production. New cement plants will be needed to produce the required construction materials, as well as concrete for tunnels, dams, and canals. Cement production will need to be developed in areas where little or none currently exist, which will require new sources of limestone, clay, and iron.

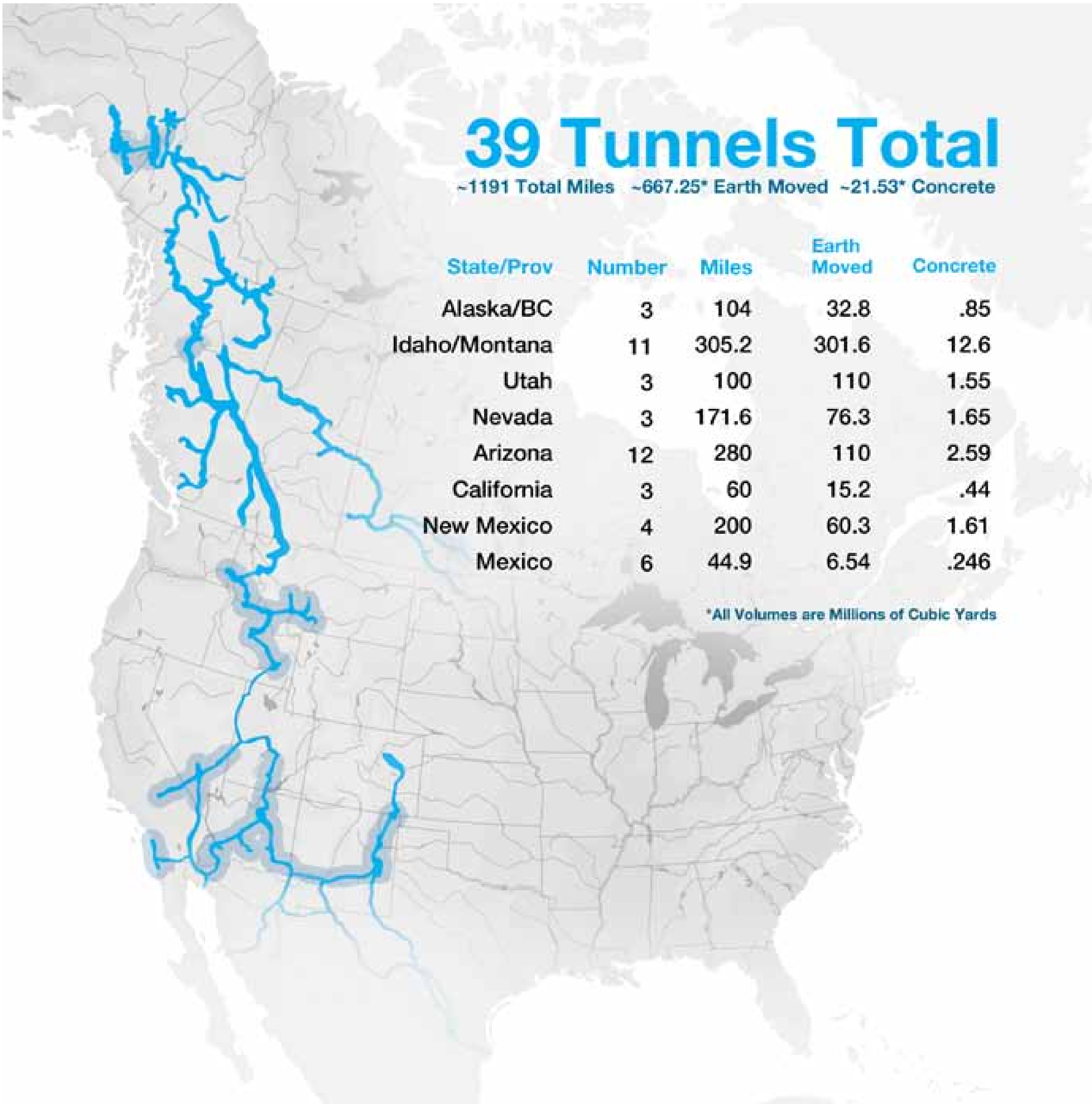
c. Steel Mills and Foundries. New steel, aluminum and copper mills, are needed for construction purposes within the NAWAPA XXI requirements, as well as for manufacturing of new rail lines. Foundries need reviving, as most of our casting is done abroad. This will include heavy rolling, forming, and metallurgy components to be produced at foundries and smelters.

d. Power and Energy Supply. Nuclear plants are needed for manufacturing materials and machinery for the project requirements, and will be added to the electrical grid to service their production. Also to be incorporated are new oil and gas production activities plus uranium and coal mining, plus associated water and wastewater treatment systems. In the construction of new nuclear plants for manufacturing, designs should be revived for using the nuclear process heat in rotary kilns for cement-making, thus making the plants a true co-generation facility.

4. Machinery Production

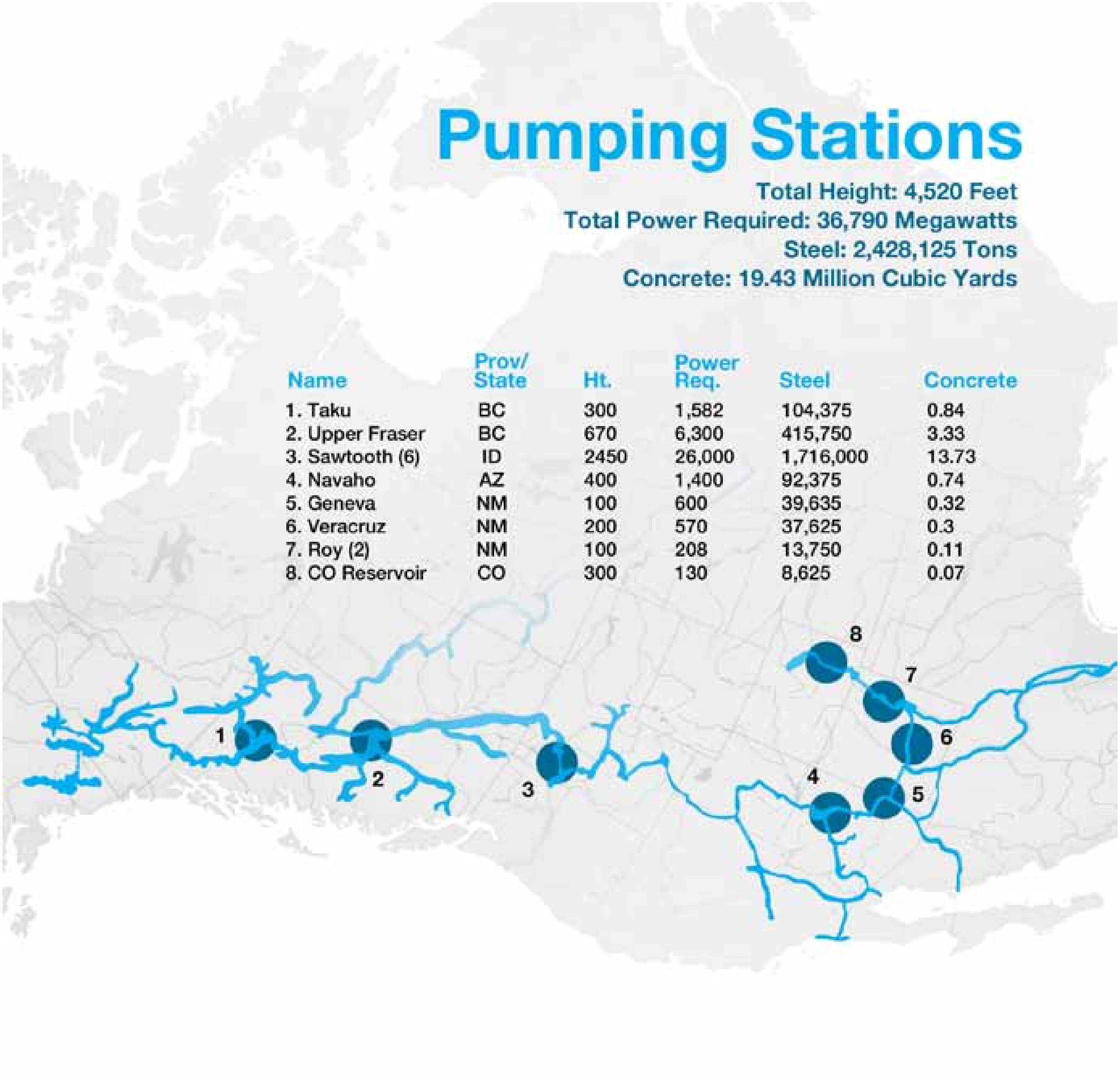
Machine-tool operators will be at a premium, and it is our understanding that a large number of retired machinists will be necessary to head programs to train operators for the manufacturing of project components. There will be a great need for computer numerical control (CNC) technicians, both data entry and programmers, as well as AutoCAD draftsmen who will pose leading-edge methods of visualization. There will be also be a significant need for skilled welders to be trained at vocational schools and colleges.

a. Construction Machines and Equipment. Excavators and large-capacity trucks and other earth-moving equipment will be used in most areas. Crane industries are needed which will be the most important in the heavy equipment aspect of the project in the construction of dams. A shortage of 500-



ton capacity cranes is expected. Factory capacity for the manufacturing of earth-moving equipment will need to be addressed, and perhaps augmented, especially within the NAWAPA XXI regions.

The NAWAPA XXI systems have 39 tunnels, for a total length of 1,190 miles, requiring many new Tunnel Boring Machines (TBM) for medium to hard rock, and from stratified to blocky conditions. An estimated 667 million cubic yards of earth will be tunneled. All tunnels will be concrete lined for hydraulic efficiency for a total estimate of 12.6 million cubic yards of concrete, assuming a concrete thickness of 4 inches. Explosives will be needed in order to facilitate tunnel drilling and certified technicians will be involved. In addition to the transmission tunnels, drilling machines will be needed for all

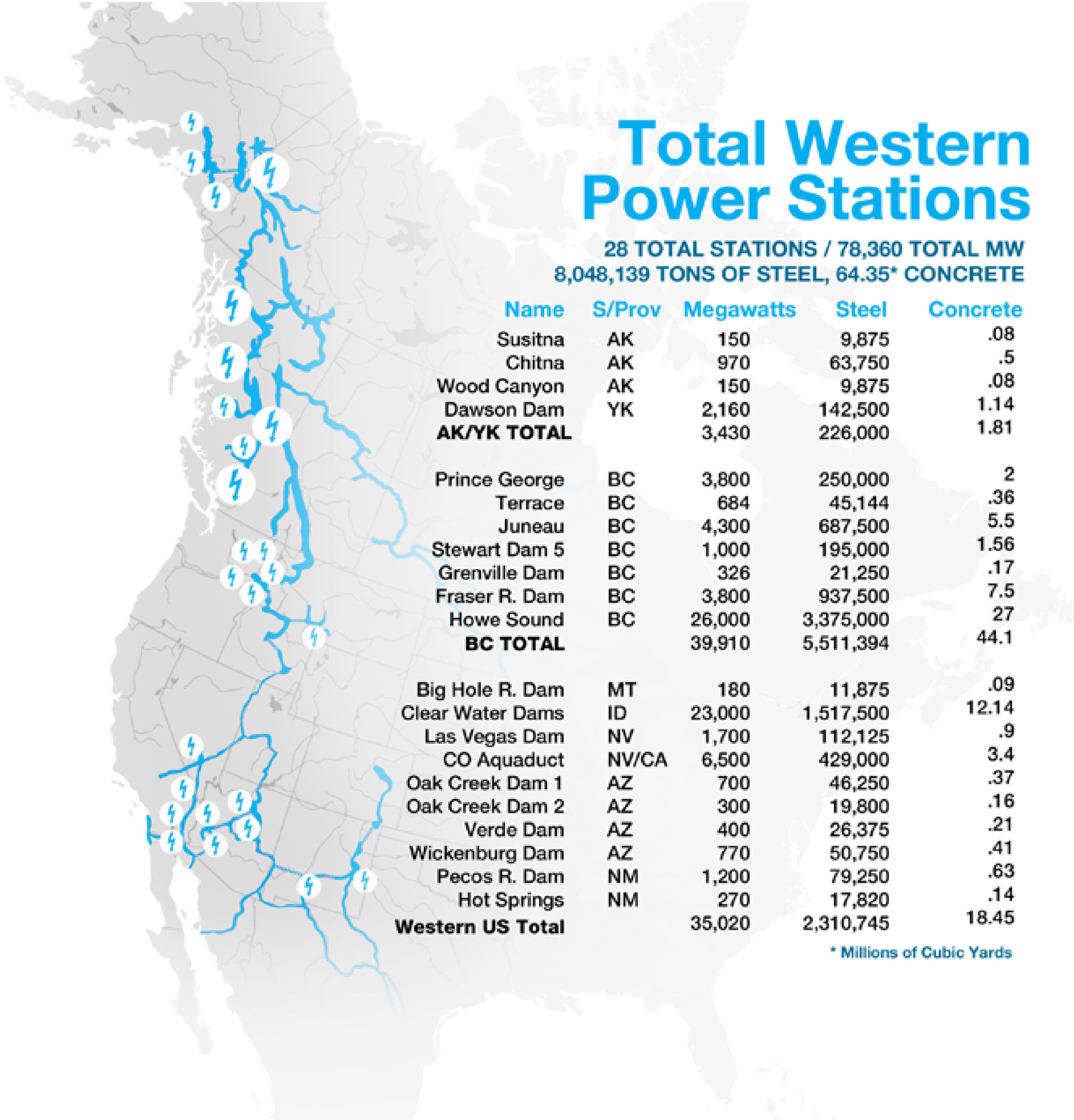


Name	Prov/ State	Ht.	Power Req.	Steel	Concrete
1. Taku	BC	300	1,582	104,375	0.84
2. Upper Fraser	BC	670	6,300	415,750	3.33
3. Sawtooth (6)	ID	2450	26,000	1,716,000	13.73
4. Navaho	AZ	400	1,400	92,375	0.74
5. Geneva	NM	100	600	39,635	0.32
6. Veracruz	NM	200	570	37,625	0.3
7. Roy (2)	NM	100	208	13,750	0.11
8. CO Reservoir	CO	300	130	8,625	0.07

of the diversion tunnels constructed in conjunction with dams in the project.

b. Pumping Equipment. For the pumping stations, requiring 36.8 GW of electricity, industries will be needed to manufacture very large motors, large capacity pumps, valving, fittings, intake and discharge headers, and environmental enclosures. An army of 100,000-130,000 horsepower motors will be required for the current design of the Sawtooth Lift components of the NAWAPA XXI system alone, as well as at the other major pumping sections of the system, e.g., the Taku River Lift, Upper Fraser River Lift, Navajo Lift, Lake Geneva, and Pecos River Reservoir.[1] An inter-tie backup system and spinning reserve will also be required components of the design of the water pumping facilities. 2.4 tons of steel and

1. Currently there is no U.S. pump manufacturer sufficient for the task; it may be possible to receive a license from Hitachi until such capacity is developed.



Total Western Power Stations

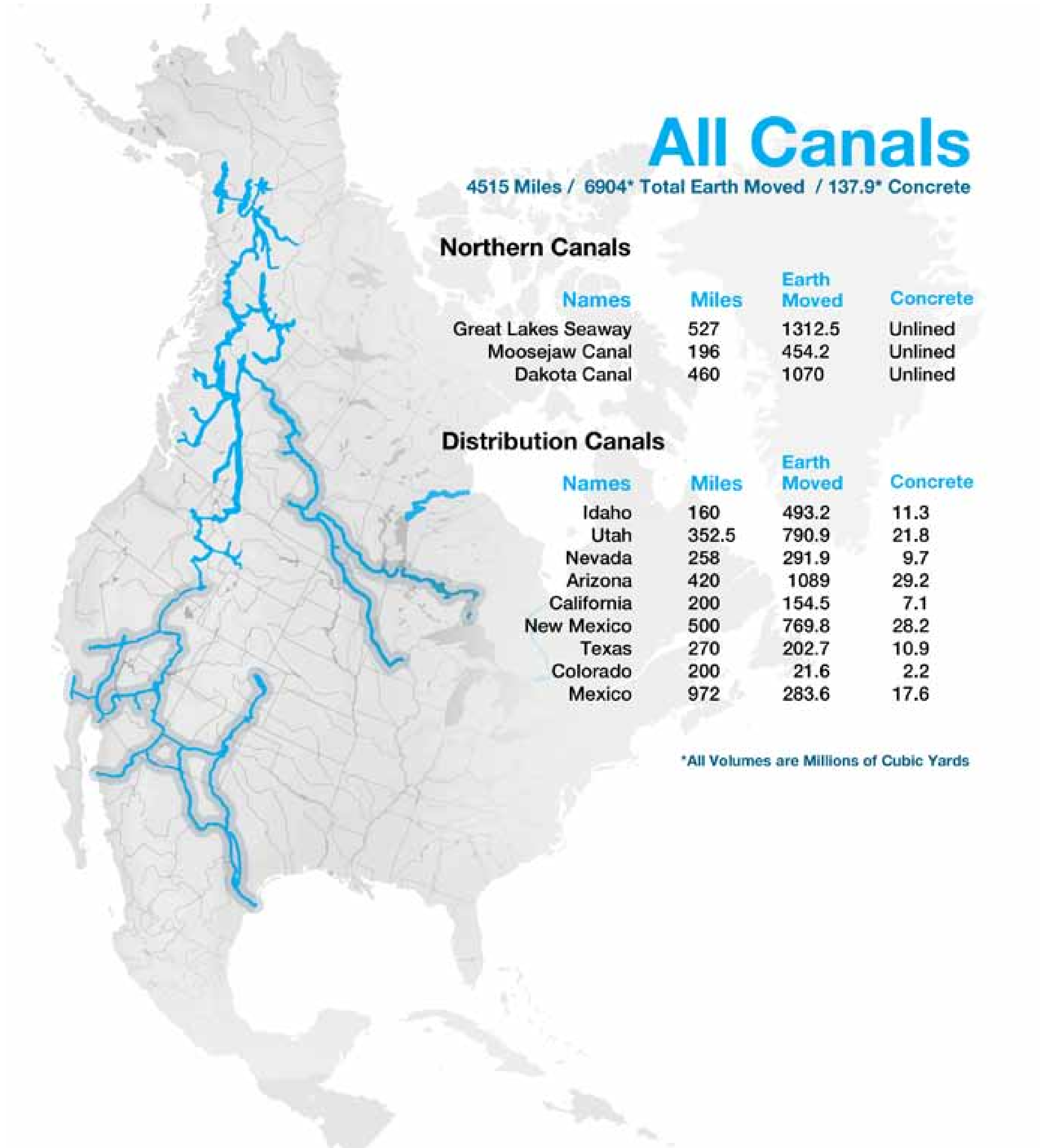
28 TOTAL STATIONS / 78,360 TOTAL MW
8,048,139 TONS OF STEEL, 64.35* CONCRETE

Name	S/Prov	Megawatts	Steel	Concrete
Susitna	AK	150	9,875	.08
Chitna	AK	970	63,750	.5
Wood Canyon	AK	150	9,875	.08
Dawson Dam	YK	2,160	142,500	1.14
AK/YK TOTAL		3,430	226,000	1.81
Prince George	BC	3,800	250,000	2
Terrace	BC	684	45,144	.36
Juneau	BC	4,300	687,500	5.5
Stewart Dam 5	BC	1,000	195,000	1.56
Grenville Dam	BC	326	21,250	.17
Fraser R. Dam	BC	3,800	937,500	7.5
Howe Sound	BC	26,000	3,375,000	27
BC TOTAL		39,910	5,511,394	44.1
Big Hole R. Dam	MT	180	11,875	.09
Clear Water Dams	ID	23,000	1,517,500	12.14
Las Vegas Dam	NV	1,700	112,125	.9
CO Aquaduct	NV/CA	6,500	429,000	3.4
Oak Creek Dam 1	AZ	700	46,250	.37
Oak Creek Dam 2	AZ	300	19,800	.16
Verde Dam	AZ	400	26,375	.21
Wickenburg Dam	AZ	770	50,750	.41
Pecos R. Dam	NM	1,200	79,250	.63
Hot Springs	NM	270	17,820	.14
Western US Total		35,020	2,310,745	18.45

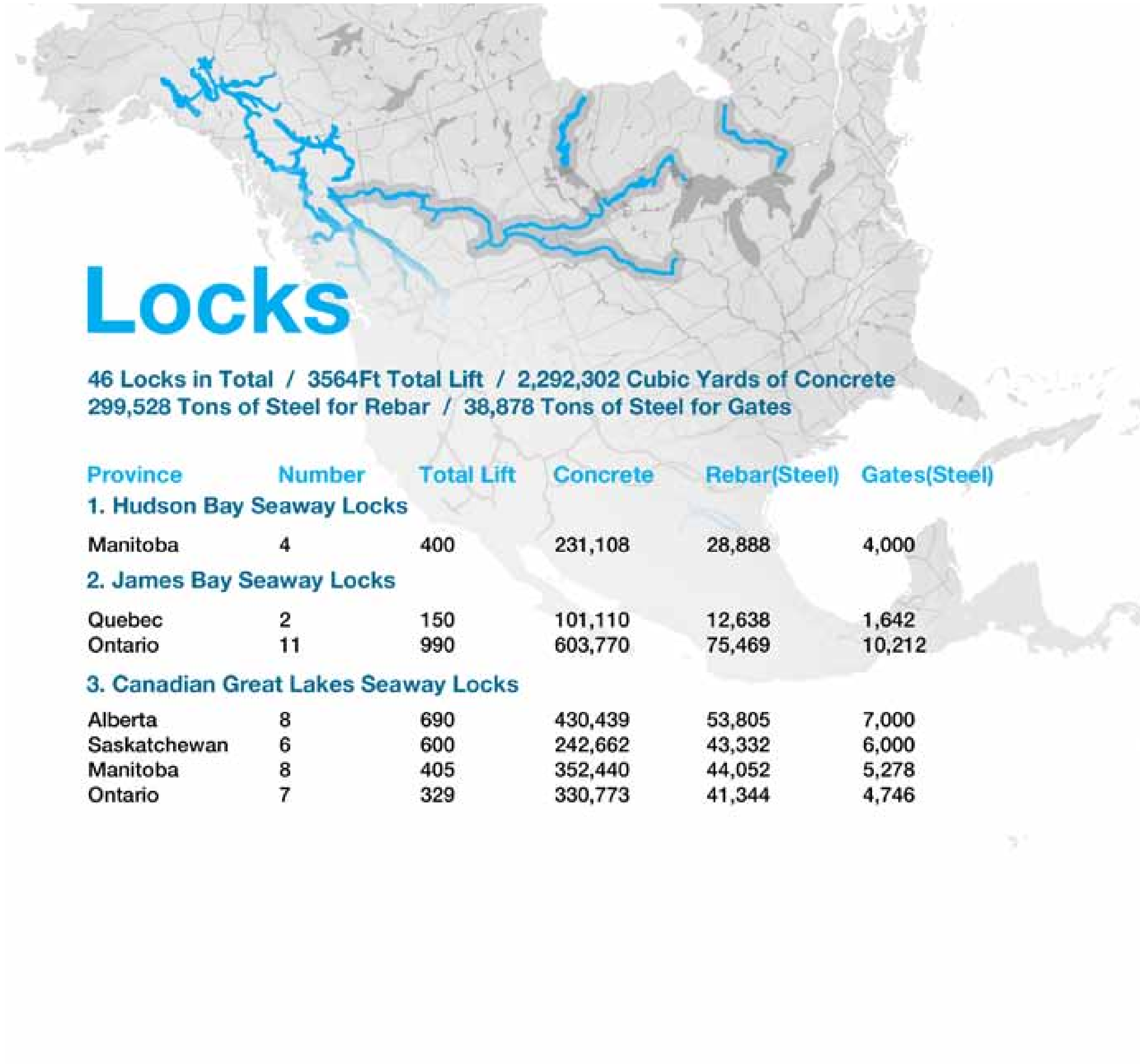
* Millions of Cubic Yards

19.4 million cubic yards of concrete have estimated for 14 pumping stations involved.

c. Power Generation Components. For the hydro-powered generating stations, industries will be required to manufacture forebay, penstocks, headgates, turbine wheels (with huge impellers), generating units, switchgear, transmission lines, structures, enclosures, and site development. Dam sites that involve high head generation may demand more complex requirements. For the 28 power plants under consideration in this report, 8 million tons of re-inforcing steel, and 64 million cubic yards of concrete are estimated. The transmission lines will require an estimated 10,290 miles of aluminum wire, for a total of 25,807 tons of aluminum. The lines will require 15,620 towers requiring 210,910 tons of steel (avg. 14 tons each based on EPRI 1982 survey of 670 towers).



d. Canals. Excavating machines, as well as specialized canal excavators, track drills, and large-capacity trucks will be needed for the estimated 6,904 million cubic yards of earth moved. Cement processing will be needed for the 138 million cubic yards of concrete that will be poured for lining. 4,515 miles of canals are anticipated. Where canals are not constructed, but natural waterways used instead, dredging may be required.



Locks

46 Locks in Total / 3564Ft Total Lift / 2,292,302 Cubic Yards of Concrete
299,528 Tons of Steel for Rebar / 38,878 Tons of Steel for Gates

Province	Number	Total Lift	Concrete	Rebar(Steel)	Gates(Steel)
1. Hudson Bay Seaway Locks					
Manitoba	4	400	231,108	28,888	4,000
2. James Bay Seaway Locks					
Quebec	2	150	101,110	12,638	1,642
Ontario	11	990	603,770	75,469	10,212
3. Canadian Great Lakes Seaway Locks					
Alberta	8	690	430,439	53,805	7,000
Saskatchewan	6	600	242,662	43,332	6,000
Manitoba	8	405	352,440	44,052	5,278
Ontario	7	329	330,773	41,344	4,746

e. Locks. Will require double steel mitre gates, and reinforced concrete, plus interlocking equipment needs. The 46 locks contemplated lead to a total of 2.29 million cubic yards of reinforced concrete, 299,528 tons of rebar, and 38,878 tons of steel gate.

f. Transportation Machines. For the transportation of machinery, power and pump station components, steel, copper, etc, numerous rail lines will be required, necessitating a revived rail car industry, with an emphasis on 150 ton Schnabel cars, and heavy capacity track. Increased steel capacity will be required for these new rails. High quality roads and pipelines for gas and oil could be located adjacent to canals and railroads.

5. National and International Supply Lines

a. Conventional Roadways & Railways. New and upgraded conventional roadways and railways will need to be developed in relation to NAWAPA XXI.

b. Maglev Railways & Power Systems. Maglev railways need to be considered within the context of technological advancements for use in NAWAPA XII.

Dams

95 Total / 105.8 MCY of Soil Moved / 19224.16 MCY of Earth Dam Material
2722 MCY of Concrete / 430.4 Million Tons of Rebar (Steel)

Province/State	Dams	MCY Soil Moved	MCY Earth Dam Material	MCY Concrete	Mil. Tons Rebar
Alaska	6	29.2	0	724.5	181
Yukon	3	13.6	1225	0	0
British Columbia	26	43.5	10921	1442.6	180
Montana	7	5.76	618.7	167	20.9
Idaho	15	1.78	680.5	45.9	5.7
Utah	6	0	325.1	0	0
Nevada	2	0	325.1	0	0
California	2	0	65.6	0	0
Arizona	10	12	2357.5	342	42.8
New Mexico	3	0	1540.4	0	0
Alberta	6	0	973	0	0
Saskatchewan	5	0	133	0	0
Manitoba	4	0	59.26	0	0

6. Construction Support Infrastructure

Housing and support facilities, including medical, recreation, and security will be required for most construction sites. Remote cold weather sites will be particularly challenging. Initially, there will need to be temporary rough camps for those who are building access roadways to base camps as well as the temporary housing at the construction sites. In certain cases the temporary infrastructure will be intended to become permanent to accommodate the people who will operate the finished system.

The central component is the temporary power system and distribution of electrical power. The optimum solution would be modular nuclear plants that could be delivered in pieces and assembled on site. There will be a need for fleets of heavy-lifting helicopters and landing sites for aircraft to transport supplies in remote areas.

Phase 3 – Construction

As stated above, it is intended that the construction of NAWAPA XXI's component parts will be in multiple stages of design, construction and operation, advancing as quickly as the development and application of resources allow. This obviously indicates that virtually all areas of employment will be involved over a period of 20-30 years. The physical constructions will be typically led by civil engineers presiding over the various subcategories of engineering specialties, who will supervise their relevant tradesmen, such as millwrights, electrical workers, pipe fitters, ironworkers, metallurgists, carpenters, and cement workers.

1. Site Preparation and Reservoirs

This activity is central to virtually all construction projects. Operating engineers, heavy and specialized equipment operators, surveyors, lumberjacks, and laborers will perform the bulk of this work.

a. Clearing Limits, Staging Areas.
b. Clearing, Logging, Grubbing.
c. Erosion Control Structures.

2. Dams and Hydroelectric Plants

The following are necessary preconditions for constructing dams.

a. Temporary power distribution. This is the power needed to run the construction facilities on site.

b. Cranes and Tramways. The building and removal of these elements will require the needed supply lines mentioned.

c. Cofferdams. Two cofferdams are usually built, one upstream and one downstream of the proposed dam, after an alternative diversion tunnel or channel has been provided for the river flow to bypass the dam foundation area.

d. Bypass Tunnels and Pumping Stations

3. Tunnels, Pumping Stations, Power Stations, Canals, Aqueducts, Pipelines

As stated earlier, more construction specifics will be added in the second edition.

Totals

Type	Millions of Cubic Yards Earth Moved	Millions of Cubic Yards Concrete	Millions of Tons Steel
Dams	19330	2722	430
Tunnels	667.25	12.6	
Canals	6904	137.9	
Powerhouses		64.35	8.26
Pumps		19.43	2.43
Locks		2.2	0.34
Totals	**26901.25**	**2958.48**	**441.03**

The calculations found in this section, for volumes of earth moved and concrete poured, and tons of steel and aluminum, in relation to the detailed maps provided, were all originally done by the authors. Basic water amounts and description and mileage of canals and tunnels provided by original design reports, and heights and widths of dams found by subsequent software mapping, were used for calculations. (See www.larouchepac.com/nawapa.)

Powerhouses, dams, canals, and locks in Manitoba, Ontario, and Quebec that were not associated with the Hudson and James bay canals, although proposed in the original NAWAPA design, were not calculated for this report and are not included in the totals provided. The earth-moving requirement is therefore lower than the variously published amounts with regard to the project. No estimate was made for diversion tunnels. No consideration was given to having dams also serve as roadways, which would result in a much thicker dam. Regarding concrete, dams were assumed to be earth-fill, as in the original reports, except in Alaska, Southwestern BC, and one dam each in MT, AZ, and ID. Seismic activity is taken into consideration for the Alaskan dams, hence the use of a doubled steel requirement for these dams in the calculations. Additional concrete would be required if some length of canal is not on the ground, but rather above ground like the classic aqueduct.

Phase 4 - Operation

1. Reservoir System Control. An array of scientists will be needed for the maintenance of the system of total water management. The primary requirement will be that of system control. The finished system of reservoirs will require a diagnostic system of flows and levels of the utmost precision and foresight. The control center will monitor all aspects of the system to maintain the needed schedule of water deliveries and water levels.

2. Weather Monitoring. The needs of the control center will have to be met by the best understanding of space weather and Earth weather. A branch of the system control center will be continually processing the most up-to-date data available, for forecasting weather and its effects on reservoir and canal levels and flows. This will require climatologists, meteorologists, and specialists in the rapidly growing science of space weather.

3. Reservoir and Canal Management. Other sciences needed for the maintenance of the system will be in the treatment of water to be delivered in canals and reservoirs, as well as in the multiple purposes of the reservoirs themselves. Available methods of water retention and the minimization of Southwest reservoir evaporation will be studied. For water treatment, fish, plant, and microorganism biologists will be needed, along with water and waste water treatment systems, and harmful biota mitigation. Along with water quality, similar application of methods for water treatment, and the control, use, and engineering of plants, fish, and microorganisms will be done to effect a maximization of aquatic protein, harvested by numerous fishery programs established in cooperation with the NAWAPA XXI administration.

4. Agriculture and Land Cover Programs. State and Federal organizations will work with the NAWAPA XXI administration to utilize land most effectively. Various land rehabilitation programs will be designed. The use of NAWAPA XXI water may be sold in cooperation with forestry and agriculture programs which give incentives toward specific uses of the water. Scientific institutions which study the effect of moisture in arid regions toward effecting changes in local climate and weather patterns, will collaborate in planning specific types of land cover for specific regions in which water is sold, to direct the desired changes in precipitation, and moisture levels.[2]

Part 2: Current Capacity and Potential Technology

1. Skilled Labor Training

A quick search of the Bureau of Labor Statistics database provided the following. Unions and other more reliable sources on current U.S. manufacturing are encouraged to provide more accurate information.

The currently unemployed craftsmen in the skilled trades can cover some of the initial work required; however, the lack of skills among the current labor force and idle unemployed, when compared to the needs of NAWAPA XXI, mean that various training programs will be needed. Some of these will be new CCC-like programs to bring in the younger age bracket of the workforce which has little experience in skilled labor.

To broadly characterize the training programs needed to fill the skill gap identified, it is estimated that as little as a 12 to 24 month training period is needed for many of the trade professions involved in the project, and most of it should be on-the-job training (OJT). Other training programs are said to be 2-3 years for construction craft, and 3-5 years for professional engineers. Most trade unions identified have training programs that will address specific skills for the individual trades: safety, proper use of tools and equipment, mathematics, and plan reading on a cooperative basis with educational institutions. These training programs will necessitate expanding existing college and university education and training activities plus additional high school vocational programs.

Of greatest importance will be the transmission of irreplaceable knowledge from the older generation of retired or soon to be retired skilled workers and scientists. For example, it is our assessment that one of the primary apprenticeship programs required is a crash program of training new machine tool specialists. Master machinists must organize programs for the transmission of their knowledge in order to fill the large gap presently existing in the machine tool sector of the machining trade. A large percentage of machine tool specialists are currently retired, but will be required as teachers for the training programs of a new generation of machinists. Second on the list of crash training programs would be the training of welders, mechanical engineers, and other professions that are not specifically related to assembly of the NAWAPA XXI system components, but are related to the production and infrastructure for those system components.

When the labor training programs are defined for NAWAPA XXI, one proposal to be researched is the management of the labor training programs for all of the trades by the U.S. Army Corps of Engineers. The U.S. Army Corps has also conducted a study on employment and training required for a revitalization of the Mississippi River lock and dam system. This study should be located, and used for reference.

2. Current Manufacturing Capacity

The U.S. manufacturing capacity is needed to meet the requirements listed in Part 1 of this section. A definition of the precise gap between current capacity and the requirement for NAWAPA XXI has not been completed by the authors. However, such a demonstration would show the drastic collapse from our once mighty power and industrial security, which we possessed at the time this project was proposed in 1964.

A quick search of the Bureau of Labor Statistics provided the following.

2. "Engineering Our Southwest Biosphere" (larouchepac.com/node/17652)

U.S. Labor Capacity

Construction Craft	Employed	Unemployed
Heavy Equipment Operators (Earth Movers)	18,120	4,911
13.8KV Motors and Switch Gear Operators	4,220	1,201
500KV Substations and Transmission Line Workers	8,830	2,409
Linemen	105,540	21,908
Switchgear and Transformers Workers	3,400	
Millwrights	15,070	3,229
Electrical Workers	372,380	54,011
Pipe Fitters	280,420	64,285
Carpenters	465,710	105,010
Cement Workers	124,020	28,884
Total Ironworkers	314,000	49,667
Welder Ironworkers	86,920	14,599
Reinforcing Ironworkers	18,410	4,490
Riggers	13,600	2,149
Structural Ironworkers	46,900	8,898
Skilled Machinists		
Computer Numerical Control	123,600	19,929
Programmers	16,360	1,929
AutoCAD Draftsmen	27,960	3,919
Skilled Welders	38,530	6,490
Turning/Stamping (Production & Operation)	21,205	3,500
Boring, Drilling, Milling (Production & Operation)	26,266	4,995
Professional Engineers		44,149
Civil Engineers	249,120	602
Rail Engineers	3,930	20,555
Electrical Engineers	147,750	48,291
Mechanical Engineers	234,400	3,206
Nuclear Engineers (& Technicians)	24,570	2,457
Material Science	8,390	3,600
Metallurgical Engineers (Materials Engineers)	21,830	

3. Potential Technologies and Science Involved

Since the original proposal for a system of total continental water management was put forward, many new technologies, methods of scientific analysis, and methods of construction have become commonplace or have been proposed. The considerations below may change aspects of the plan, and many more could be added by relevant experts.

For the geological mapping of the project, Light Detection and Ranging (LIDAR) technology could greatly enhance the precision of the design and adjust the project for optimal effect.

For those dams found necessary to be concrete, the Roller Compacted Concrete method may lead to quicker construction, less material requirement, and increased seismic stability.

Extremely cold and permafrost conditions in the north will necessitate technologies in the material sciences for dealing with these conditions. Other challenges regarding icing of dams and canals will need attention.

The effect of the largest reservoirs ever built on resettling of rock layers, along with water seepage and flow characteristics, will need to be studied, and a coordinated analysis throughout the system may provide useful data for general earth crust science.

New reactor core diagnostic experience in the nuclear industry should be investigated for possible control system application in reservoirs and canals.

U.S. Manufacturing Capacity	Factories	Tons	Units	Idle Capacity
Earth Moving	3,540		77,880	
Raw Materials				
Steel	119	1,900,000		23.7% 2011
Copper	54	1,190,000		14.9% 2010
Aluminum	18	3,090,000		24% 2010
Cement	113	63,500,000		45% 2010
Foundries				
Die Casting	625	NA		29% in 2010
Alluminium Rolling	747	2,200,000		
Iron/Steel Forming	871	4,500,000		
Cement Sand	2,545	6,000,000		
Machine Production & Operation				
Turning/Stamping	389			29% in 2010
Boring/Drilling/Milling	299			28% in 2010
Power Generation	1,369	NA	33,490	19% in 2010
Generating Units	435	NA	23,490	19% in 2010
Switchgear	502	NA	10,000	23,490
Transmission Lines	432	43,000	8,600,000 meters	10,000
				8,600,000 meters
Pumping Stations				
Large Capacity Pumps	110	1,600,000	2,940	
Transportation				
Rail Lines	11	84,000	560	12%
Rail Cars	31	1,050,000	21,000	23%
Schnabel Cars	9	110,000	1,100	13%
Helicopters (Piston/Turbine)	29		1,300	24%

Breakthroughs in the tunnel boring industry in recent decades could drastically alter the project schedule, as well as open up alternative routes which may not have been feasible before.

New composite concretes will be required with regard to canal, tunnel, and aqueduct linings to achieve optimal flow rates.

Lock technologies have been advanced and applied in Third World countries in recent decades, well beyond those systems currently in operation in the U.S. and Europe, and could be applied in the new barge canals in the project.[3]

New anchor bolt technology for use in building rail lines into mountainous areas, which supersede trestle bridges, should be investigated for employment in the project.

The use, testing, and employment of new technologies associated with the long-term construction of NAWAPA XXI should be paired with the needs and plans of Arctic and lunar industrialization, as well as the long-term design program for a future Mars colony, making the most of all cutting-edge technology investment.

Construction of over 1,000 miles of tunnels in the western states, and the rail lines and reservoir sites in Alaska, Yukon, and British Columbia, will create a vast potential for mining and geology: huge mineral deposits will become accessible; major scientific, geological, and archeological findings and breakthroughs in the

3. Interview with Elghi Segovia (larouchepac.com/node/16970)

geological sciences will become possible; undiscovered ores to be used for entirely new steel alloys may exist; industrial development potentials include acid mining and new mining techniques in general. In associated developments in the Canadian High Arctic, great resource potential exists, and the high incidence of asteroid hits in the Canadian High Arctic will allow for unique mantle observations.[4]

Part 3: Investment Schedule Analysis

The growth of the economy over the period of the project's completion will be divided into anticipated stages. The investment into these stages will be guided to ensure increasing productivity of all sectors involved. The technology and productive power needed for future phases will be planned and invested years in advance to ensure its existence and availability when a stage of the pre-construction phase or construction phase is reached where it is required.

A rough estimate of this investment process is described here.

Based on the analysis of existing and needed resources in Parts 1 and 2, along with an analysis to determine challenging areas of the project design, an approximate schedule and order of operations will be made. These resources will be chiefly a) amount of skilled labor available, b) categories and degrees of skill, c) scientific knowledge available, d) manufacturing capability, e) technological level of manufacturing, f) infrastructure capability, and g) the technological level of the infrastructure.

The intention of the government to support a detailed design of NAWAPA XXI will have an immediate effect of calling these resources to full attention. The agreement of the three nations involved to go ahead with its construction will then put these resources immediately into motion. Once the labor training and preconstruction phases begin, there will be a constant growth of resource capacity (a-g), starting slowly at first, and picking up more speed.

Short-term outputs of initial investment related to this growth will become available, such as new labor pools, categories of labor skill, manufacturing facilities, newly created electrical power and supply lines, etc. The allocation of these short-term outputs, and tracking the continued growth of resource capability for future allocation, will form investment cycles of various length.

The data collected by the control center as defined in Part 1, regarding the state of these resources in relation to project scheduling, will be analyzed by a division of the control center to detect the appropriate form which the investment cycles will take. This investment cycle management division will determine how to meet pre-construction and construction phase needs, while simultaneously increasing the power of all of the layers of the economy involved. The standard will be that productivity is ahead of production capability at all times; there should be greater flexibility and capacity than production requires. The division will work with the economic sectors and Federal agencies involved to steer the allocation of built-up capability such that the overall productivity curve stays above the baseline requirement.[5]

The most important task of the investment cycle management division will be to anticipate the future qualitative needs of the project and related sectors of economy, and incorporate those needs into the modes of training and manufacturing investment. More complicated stages of project construction must be anticipated in the earlier investment phases. The design and investment in new technologies, and the relationships between them, must be synchronized for maximum effect on all areas. Requirements must be anticipated which lend themselves to improving quantity and quality of performance.

Alterations to manufacturing design and skill requirements will be built into the process to add elements which may not appear immediately useful for the project itself, but will later be drawn from, when the economy is built to the capacity for major technological advancement, such as an engineering cadre for lunar industrialization.

During the approximately generation-long construction of the project, the continued function of reinvesting built-up capability will build a new economy —one operating on a higher baseline of overall potential for technological development, infrastructural capacity, and production.

4. Interview with Joseph Montgomery (larouchepac.com/node/16731)

5. The management division will be in coordination with government officials who are working with the specific credit fund set up by Congress, as described in Section III, and Appendix 2. The same future-oriented investment process of the management division of the control center will be reflected in the actualization of the funded public debt, within the operations of a newly established system of public credit.