

Vanderbilt, Pamela/SAC

From: Joseph_Barnes@URSCorp.com
Sent: Thursday, July 21, 2011 5:22 PM
To: Vanderbilt, Pamela/SAC
Cc: Sou, Sean; Goyal, Ajay; Bogener, Dave; Jeff_Herrin@URSCorp.com; John_Biale@URSCorp.com
Subject: Fw: NODOS Concept Schedule - URS Revised
Attachments: 2011-07-21 NDOS Modified 1 pg 11by17.pdf

Pamela - Here is a copy of the construction schedule with the preparation date revised to 7-2011. Everything else remains the same on the schedule.

Thanks

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----- Forwarded by Joseph Barnes/Sacramento/URSCorp on 07/21/2011 05:18 PM -----

John Biale/Sacramento/URSCorp

07/21/2011 05:16 PM

To Joseph Barnes/Sacramento/URSCorp@URSCorp

cc Mike Egge/Sacramento/URSCorp@URSCORP

Subject Re: Fw: NODOS Concept Schedule - URS Revised [Link](#)

Revised header on schedule

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Vanderbilt, Pamela/SAC

From: Joseph_Barnes@URSCorp.com
Sent: Thursday, July 21, 2011 4:21 PM
To: Vanderbilt, Pamela/SAC
Cc: Sou, Sean; Goyal, Ajay; Bogener, Dave; Jeff_Herrin@URSCorp.com; Mike_Egge@URSCorp.com
Subject: Fw: NODOS Equipment Use Schedule Update
Attachments: Equipment Spreadsheet 6-29.xlsx

Pamela - Attached is a revised equipment spread table base upon the clarifications we discussed in the conference call today with Mike Egge and I. It includes information on the transmission lines also.

The total volumes for dam construction for the 1.80 and 1.27 MAF reservoirs is as follows based upon the quantities in the DWR cost estimates:

	1.8 MAF	1.27 MAF
Sites Dam	3,837,000 CY	2,853,000 CY
Golden Gate Dam	9,267,000 CY	5,987,000 CY
Saddle dams	7,576,000 CY	2,178,000 CY

Equipment utilization is directly related to volume for dam construction. The equipment information URS provided was for the 1.8 MAF reservoir. For the 1.27 MAF reservoir (Alternative A), proportion the equipment numbers down by the ration of the volumes (approximately 0.75 for Sites for example). Other facilities would all basically be the same.

For Alternative B, remove the Sacramento River pumping plant from the numbers. The Delevan pipeline still remains for this option.

Hope this helps. If you have any further questions, please let me know.

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----- Forwarded by Joseph Barnes/Sacramento/URSCorp on 07/21/2011 03:59 PM -----

Mike Egge/Sacramento/URSCorp

To Joseph Barnes/Sacramento/URSCorp@URSCorp

cc

07/21/2011 03:33 PM

Subject NODOS

Joe,

Changs as requested.

Michael

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[attachment "Equipment Spreadsheet 6-29.xlsx" deleted by Joseph Barnes/Sacramento/URSCorp]

From: Sou, Sean [<mailto:sou@water.ca.gov>]
Sent: Wednesday, June 29, 2011 2:02 PM
To: Haydon, Wendy/SAC
Cc: Marr, Jennifer; Stygar, Shem; Brown, Josh
Subject: FW: NODOS Equipment Hours

Wendy,

Attached are the updated equipment operating hours and staff estimates for major construction operations of NODOS facilities. Please forward it to your authors who need it for GHG, noise, air quality impact analysis. If they have questions, please have them contact Joe Barnes of URS (contact below).

Thx,
Sean

From: Joseph_Barnes@URSCorp.com [mailto:Joseph_Barnes@URSCorp.com]
Sent: Wednesday, June 29, 2011 12:12 PM
To: Goyal, Ajay; Bogener, Dave; Arrate, David; Jeff_Herrin@URSCorp.com; Wieking, James; Sou, Sean
Cc: Mike_Egge@URSCorp.com
Subject: NODOS Equipment Hours

Attached is an Excel Spreadsheet tabulating the equipment operating hours for all of the major construction operations relative to NODOS. Hours were developed based upon available quantities of materials to be moved or delivered (from available DWR cost estimates) and realistic equipment capacities.

Each major activity is shown on a separate tab in the spreadsheet. Each tab includes a summary equipment table (usually color highlighted) and shows all of the backup assumptions and calculations used to develop the summary table. Each summary table also includes a manpower estimate.

If you have any questions, please call or email me.

Thanks

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Dams & Sites Inundation	Golden Gate				All other dams		
Foundation excavation	2,910,000	CY			2,185,500	CY	
Scraper removal 25Cy	116,400	loads					
Use 10 hr. work day							
Assume 20 min cycle time	30	loads/day/scraper					
	3,880.00	Scraper days					
Assume 20 Scrapers	194	Construction days			146	days	340
Spread sheet shows:	64	scrapers					
	1800	Construction days					
	15000						

Core Material - 1 mile haul	3,460,000	CY			3,079,690	CY	
Off Road truck 20 CY	173,000	Loads					
Use 10 hr. work day							
Assume 15 min cycle time	40	loads/day/truck					
	4,325	Truck days					
Assumed number of trucks	24	Trucks					
Calculated work days	180	Construction days			160	days	341
Spread sheet shows:	250	off-road trucks					
For all Dams	1800	Construction days					
	19200	CY/day					

Filter drain 35 mile haul	2,494,000	Tons			1,824,700	Tons	
Use 1.6T/CY	1,558,750	CY			1,140,438	CY	
Highway truck 12 CY	129,896	Loads					
Use 10 hr. work day							
Assume 2-hr cycle time	5	loads/day/truck					
Calculated load days	25,979						
Assumed number of trucks	120	Trucks					
Calculated work days	216	Construction Days			158	days	375
Spread sheet shows:	460	Highway trucks					
For all Dams	1800	Construction days					
	11520	CY/day					

Rock Fill Zone 3 - 1-3 mile haul	2,870,000	CY			3,224,100	CY	
Off Road truck 20 CY	143,500	Loads					
Use 10 hr. work day							
Assume 20 min cycle time	30	loads/day/truck					
	4,783	Truck days					
Assumed number of trucks	24	Trucks					
Calculated work days	199	Construction days			224	days	423
Spread sheet shows:	250	off-road trucks					
For all Dams	1800	Construction days					
14400 CY/Day							

Random Fill 1-3 mile haul	1,470,000	CY			4,233,900	CY	
Off Road truck 20 CY	73,500	Loads					
Use 10 hr. work day							
Assume 20 min cycle time	30	loads/day/truck					
	2,450	Truck days					
Assumed number of trucks	24	Trucks					
Calculated work days	102	Construction days			294	days	396
Spread sheet shows:	250	off-road trucks					
For all Dams	1800	Construction days					
14400							

1,160

Clear & Grub activities

Allowed area	1,193	Acres	
Assumed production	1	acre/day/dozer	
Assumed number of dozers	5	Dozers	
Days required	239	Work Days	

Demolition

Haul Tree Debris		
Building demolition material		
Assume dump trucks		
Cleared Area	1,193	Acres
Assumed Loads per cleared area	4	loads/acre
Structures	61	Structures

Assumed loads per structure	3	loads/structure
Total loads	4955	
Assumed cycle time	80	minutes
work day	8	hours
Cycles/day	6	
Total truck days	826	
Assumed truck count	10	
Work days	83	

Highway trucking

Cement Sacks	82,200	Sacks
Weight # 94#/Sack	3,863	Tons
Assume Truck Load	15	Tons
Total truck loads	258	Loads
Assume truck cycle	2	Loads/day
Assumed truck count	2	Trucks
Calculated truck days	64	Days
Allow for other trucking	100	Days
Total truck loads	164	Days

Dam Equipment list includes no concrete trucks

Golden Gate	10000	CY	Cap
Sites	3800	CY	Cap
Saddle 3	8500	CY	Cap
Saddle 5	5100	CY	Cap
Saddle 6	1200	CY	Cap
Saddle 7	2300	CY	Cap
Saddle 8a	2500	CY	Cap
Saddle 8	6700	CY	Cap
Spillway	720		
	40820	CY	Cap
Saddle 1	450	CY	Slurry Wall
Saddle 2	2000	CY	Slurry Wall
Saddle 3	2300	CY	Slurry Wall
Saddle 5	890	CY	Slurry Wall

	5640	CY	
Using road limit 9 CY trucks	5,162	Truck loads	
Assuming one hour cycle time, 8 loads per	645	Truck days	
Concrete trucks per DWR spreadsheet	8		
Calculated work days	81	Work days	
Spreadsheet shows	330	Days	

On site batch plant

Concrete dry materials	3700	LB/Cy
Total quantity	85,951	Tons
Assumed truck load	20000	LB/truck
Total loads	8,595	Loads
Assumed loads per day	5	loads/day
Truck count assumed	8	Trucks
Calculated Work days	215	Work days

Dam Equipment list includes no drill rig

Golden Gate	116,400	LF
Sites	69300	LF
Saddle Dam # 3	86500	LF
Saddle Dam # 5	42400	LF
Saddle Dam # 6	5500	LF
Saddle Dam # 7	10100	LF
Saddle Dam # 8a	11000	LF
Saddle Dam # 8	49200	LF
	390,400	LF
Assumed rate of drilling	200	LF/Day
Total Days required	1,952	Days
Assume rig Count	4	Rigs
Calculated work days	488	Work Days

Dams & Sites Inundation

Equipment	Excavation & Fill			Drilling & Grouting			Concrete			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Bulldozer	10	1,774	17,740							17,740
Compactor	10	1,535	15,350							15,350
Conc. Material Trucks							8	215	1,720	1,720
Concrete pump			-				1	81		-
Concrete Trucks							8	81	648	648
Crane			-							-
Drilling machine				4	488	1,952				1,952
Dump truck	10	83	830							830
Filter Material Loader	3	1,160	3,480							3,480
Excavator			-							-
Fork Lift - Yard			-	1	89	89				89
Fuel Truck	2	1,774	3,548							3,548
Generator			-				1	81	81	81
Grader	5	1,535	7,675							7,675
Grout Pump				4	488	1,952				1,952
Highway Trucks	120	375	45,000	2	164	328				45,328
Off-Road Trucks	24	1,160	27,840							27,840
Scraper - Excavation	20	340	6,800							6,800
Waste/ Tree loader	1	83	83							83
Water Trucks	4	1,774	7,096							7,096
			-							-
Staff	219		-	12			10			-

Funks Reservoir Modification

Embankment Volume is 1,433,000 CY

Based on Golden Gate, the volume of the filter material is approximately 1/6 of the total

Based on Golden Gate, the Foundation excavation is about 30% of the embankment volume

Chaneel excavation volume is 5,300,000 CY

Excavation - For Dam	429,900	CY
Use of Scrapers seems ideal	25	CY
Scraper loads	17,196	Scraper Loads
Move from basin cycle time assumed	30	Minutes
Loads per 10 hour day	20	loads/day/scraper
Required scraper days	860	Scraper days
Spreadsheet scraper count	10	Scrapers
Days required	86	Work days

Excavation - For Channel	5,300,000	CY
Use of Scrapers seems ideal	25	CY
Scraper loads	212,000	Scraper Loads
Move from basin cycle time assumed	30	Minutes
Loads per 10 hour day	20	loads/day/scraper
Required scraper days	10,600	Scraper days
Spreadsheet scraper count	20	Scrapers
Days required	530	Work days

Fill

Core Material, rock & random- 1 mile haul	1,194,000	CY
Off Road truck 20 CY	59,700	Loads
Use 10 hr. work day	10	
Assume 15 min cycle time	40	loads/day/truck
	1,493	Truck days
Assumed number of trucks	10	Trucks
Calculated work days	149	Construction days

Filter drain 35 mile haul	382,400	Tons
Use 1.6T/CY	239,000	CY
Highway truck 12 CY	19,917	Loads
Use 10 hr. work day		
Assume 2-hr cycle time	5	loads/day/truck
Calculated load days	3,983	
Assumed number of trucks	80	
Calculated work days	50	Construction Days

Clear & Grub activities

Allowed area	200	Acres
Assumed production	1	acre/day/dozer
Assumed number of dozers	5	Dozers
Days required	40	Work Days

Demolition

Haul Tree Debris		
Assume dump trucks		
Cleared Area	200	Acres
Assumed Loads per cleared area	4	loads/acre
Total loads	50	
Assumed cycle time	80	minutes
work day	8	hours
Cycles/day	6	
Total truck days	8	
Assumed truck count	2	
Work days	4	

Highway trucking

Cement Sacks @ 4 LF/Sack	4,250	Sacks
Weight # 94#/Sack	200	Tons
Assume Truck Load	15	Tons
Total truck loads	13	Loads
Assume truck cycle	2	Loads/day
Assumed truck count	2	Trucks
Calculated truck days	3	Days
Allow for other trucking	15	Days

Concrete

Spillway concrete	12850	CY
Total	12850	CY
Using road limit 9 CY trucks	1,428	Truck loads
Assuming one hour cycle time, 8 loads per day	178	Truck days
Concrete trucks assumed	8	trucks
Calculated work days	22	Work days
Spreadsheet shows	330	Days

On site batch plant

Concrete dry materials	3700	LB/Cy
Total quantity	23,773	Tons
Assumed truck load	20000	LB/truck
Total loads	2,377	Loads
Assumed loads per day	5	loads/day
Truck count assumed	8	Trucks
Calculated Work days	59	Work days

Drill Rig

Assumed drill footage base on Golden Gate	17,000	LF
Assumed rate of drilling	200	LF/Day
Total Days required	85	Days
Assume rig Count	1	Rigs
Calculated work days	85	Work Days

Funks Reservoir Modification

Equipment	Excavation & Fill			Drilling & Grouting			Concrete			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Bulldozer - Dam	10	285	2,850			-			-	2,850
Dozers for Clear/Grub	5	40	200			-			-	200
Dozers for Channel	20	530	10,600			-			-	10,600
Compactor	4	199	796			-			-	796
Conc. Material Trucks			-			-	8	59	472	472
Concrete pump			-			-	1	22	22	22
Concrete Trucks			-			-	8	22	176	176
Crane			-			-			-	-
Drilling machine			-	1	85	85			-	85
Dump truck	2	4	8			-			-	8
Backfill Loader	1	149	149			-			-	149
Excavator			-			-			-	-
Fork Lift - Yard			-			-	1	59	59	59
Fuel Truck	1	570	570			-			-	570
Generator			-			-	1	22	22	22
Grader	2	199	398			-			-	398
Grout Pump			-	2	85	170			-	170
Highway Trucks	80	50	4,000	2	18	36			-	4,036
Off-Road Trucks	10	149	1,490			-			-	1,490
Scraper - for Dam	10	86	860			-			-	860
Scraper - for Dam	20	530	10,600			-			-	10,600
Waste/ Tree loader	1	4	4			-			-	4
Water Trucks	4	570	2,280			-			-	2,280
			-			-			-	-
Staff	180		-	11		-	51		-	-

GCID Canal & Headworks

Excavation and compaction - Scraper cut & move	69,000	CY
Scraper capacity	25	CY
Scraper loads	2,760	Loads
Cycle time assumed	30	Minutes
Loads per 10 hour day	20	per day
Total scraper days	138	scraper days
Spreadsheet Scraper Quantity	3	Scrapers
Required work Days	46	Work Days

Road Area	1,377,000	SF
Assumed Agg Base	12	inches
Calculated Agg Base Volume	51,000	CY
Assumed Asphalt thickness	2.5	inches
Calculated Asphalt Volume	10,625	CY

Grade for canal	3	Acres
Grade for road	32	Acres
Clear & grub	1	Acre/day/dozer
Dozer duration	32	Work Days

Aggregate Base	81,600	Tons
Assume 1.6 T/Cy	51,000	CY
Assume use of dump trucks		
Dump truck capacity	10	CY/Load
Total Dump truck loads	5,100	Loads
Assume processing facility on site and 25 mile max		
Assume cycle time	75	minutes
Trips per 10 hr. day	8	Trips/day
Total dump truck days	638	Truck days
Assume trucks for work	4	Trucks
Work Days	159	Work Days

Asphalt	17,000	T
Assume 1.6 T/Cy	10,625	CY
Assume use of dump trucks		
Dump truck capacity	10	CY/Load
Total Dump truck loads	1,063	Loads
Assume processing facility within 25 miles		
Assume cycle time	75	minutes
Trips per 10 hr. day	8	Trips/day
Total dump truck days	133	Truck days
Assumed truck count	4	Trucks
Calculated dump truck days	33	truck days

Concrete Items

Box Culvert Siphon		
Assume 80'wideX 12, highX 200'long with 5 divider walls		
Assume everything 12" thick	2000	CY
Tuttle Check Structure - Allowed Volume	1000	CY
Head Gate Structure - Allowed Volume	4000	CY
County Bridge - allowed Volume	500	CY
Canal lining - allow 8" thickX 150'widthX 1000' long	3700	CY
Rehabilitation allow	200	CY
Total Concrete	11400	CY
Reinforcing assumed at 4%	912	Tons

Concrete Trucks

Using road limit 9 CY trucks	1,267	Truck loads
Assuming one hour cycle time, 8 loads per day	158	Truck days
Concrete trucks assumed	6	Trucks
Calculated work days	26	Work days

On site batch plant

Concrete dry materials	3700	LB/Cy
Total quantity	21,090	Tons
Assumed truck load	20000	LB/truck
Total loads	2,109	Loads
Assumed loads per day	5	loads/day
Truck count assumed	12	Trucks
Calculated Work days	35	Work days

Highway trucks

Rebar @ 15,000/load	122	Loads
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Assumed loads/day	2	loads/day
Assume truck count	2	trucks
Calculated work days	30	Work Days
Heavy Equipment moving	40	Work Days
Allow for check structue	50	Work Days
Allow for gate structure	60	Work Days
Allow for rehabiliation	20	Work Days
Allow for bridge replacement	30	Work Days
Calculated days for two trucks	130	Work Days

GCID Canal & Headworks

Equipment	Grading & Paving			Concrete Work			Miscellaneous			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Bulldozer	1	32	32			-			-	32
Compactor	1	159	159			-			-	159
Concrete Trucks			-	6	26	156			-	156
Crane			-			-			-	-
Drilling machine			-			-			-	-
Dump truck	4	192	768			-			-	768
Excavator			-			-			-	-
Fork Lift - Yard			-			-			-	-
Fuel Truck	1	205	205			-	1	130	130	335
Generator			-	1	26	26	1	130	130	156
Grader			-			-			-	-
Grout Pump			-			-			-	-
Highway Trucks			-	12	35	420	2	130	260	680
Loader	1	192	192			-			-	192
Off-Road Trucks			-			-			-	-
Paving Machine	1	33	33			-			-	33
Roller	2	33	66			-			-	66
Scraper - Excavation	3	46	138			-			-	138
Water Trucks	1	205	205			-			-	205
Staff Max	25		-	29		-	14		-	-
			-			-			-	-

Gravel Roads

Includes only work description included with Sites Pumping plant and tunnel estimate

Excavation and compaction - Scraper cut & move	39,000	CY
Scraper capacity	25	CY
Scraper loads	1,560	Loads
Cycle time assumed	30	Minutes
Loads per 10 hour day	20	per day
Total scraper days	78	scraper days
Spreadsheet Scraper Quantity	3	Scrapers
Required work Days	26	Work Days

Compacted fill - assume minimal relocation	35,000	CY
Scraper capacity	25	CY
Scraper loads	1,400	Loads
Cycle time assumed	30	minutes
Loads per 10 hour day	20	per day
Total scraper days	70	scraper Days
Spreadsheet Scraper Quantity	3	Scrapers
Required work Days	23	Work Days
Total work days for three scrapers	49	Work Days
Spreadsheet work days for 3 scrapers	365	Work Days

Aggregate Base	13,800	Tons
Assume 1.6 T/Cy	8,625	CY
Assume use of dump trucks		
Dump truck capacity	10	CY/Load
Total Dump truck loads	863	Loads
Assume processing facility on site and 25 mile max		
Assume cycle time	75	minutes
Trips per 10 hr. day	8	Trips/day
Total dump truck days	108	Truck days

Assume trucks for work	3	Trucks
Work Days	36	Work Days

Asphalt	1,900	T
Assume 1.6 T/Cy	1,188	CY
Assume use of dump trucks		
Dump truck capacity	10	CY/Load
Total Dump truck loads	119	Loads
Assume processing facility within 25 miles		
Assume cycle time	75	minutes
Trips per 10 hr. day	8	Trips/day
Total dump truck days	15	Truck days
Assume 3 trucks		
Truck summary		
Calculated dump truck days	123	truck days
Spreadsheet dump truck days	-	truck days
Calculate off-road truck days	-	truck days
Spreadsheet off-road truck days	2,190	truck days

Other equipment		
Loader		
Loader time would be required only for agg base	36	Work days
Pace would limit need to 1 machine	36	Loader days
Spreadsheet includes	1,095	Loader days
Bulldozer		
Allow for preliminary work before scrapers	15	Work days
Required during excavation	26	Work Days
Assume required during compacted fill period	23	Work Days
Allow for use during agg base installation	36	Work days
Total	100	Work days
Allow three bulldozers	301	Bulldozer days
Spreadsheet includes	1,095	Bulldozer days
Compactor		
Required during excavation	-	Work days

Required during compacted fill period	23	Work days
Required during agg base installation	36	Work days
Total	59	Work days
Allow three compactors	178	Compactor days
Spreadsheet includes	1,095	Compactor days
Grader		
Required during excavation/compaction	26	Work days
Required during compacted fill period	23	Work days
Required during agg base installation	36	Work days
Total	85	Work days
Allow three graders	256	Grader days
Spreadsheet includes	1,095	Grader days
Roller and water truck		
Water truck required during initial clearing	15	Work days
Required during excavation	26	Truck days
Assume required during compacted fill period	23	-
Allow for use during agg base installation	36	Work days
	100	
Allow two water trucks	201	
Grader		
Assume required during compacted fill period	23	truck days
Allow for use during agg base installation	36	Work days
Allow two graders		

Gravel Roads

Equipment	Grading			Agg Base			Paving			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Bulldozer	3	64	192	3	29	87			-	279
Compactor	3	23	69	3	29	87			-	156
Concrete Trucks			-			-			-	-
Crane			-			-			-	-
Drilling machine			-			-			-	-
Dump truck			-	3	36	108	3	5	15	123
Excavator			-			-			-	-
Fork Lift - Yard			-			-			-	-
Fuel Truck	1	64	64	1	29	29			-	93
Generator			-			-			-	-
Grader	2	23	46	2	29	58			-	104
Grout Pump			-			-			-	-
Highway Trucks			-			-			-	-
Loader			-	1	36	36	1	5	5	41
Off-Road Trucks			-			-			-	-
Paving Machine			-			-	1	5	5	5
Roller			-			-	2	5	10	10
Scraper - Excavation	3	49	147			-			-	147
Water Trucks	2	64	128	2	29	58	1	5	5	191
Staff Max	24		-	25		-	18		-	-
			-			-			-	-

Pipelines - Delevans and TRR

Length indicated as 16 miles - Delevans section 13 miles

Soil ripable to depth of 52 ft.

Estimate shows 140,000 LF for Delevans = 2X 12' dia. X 13 mi.

Excavation Items		
Excavation, Delevans pipeline, 6 mi haul	4,000,000	CY
Excavation, TRR pipeline, 6 mi haul	1,000,000	CY
Total	5,000,000	CY
Assume scrapers, 25 CY	200,000	Loads
With 8 hr. day & 40 minute cycle time	12	loads per day
	16,667	Loader days
Using spreadsheet 16 scrapers	1,041.67	Days
Spreadsheet shows	300.00	Days
Note:		
URS Schedule shows 1014 days for pipeline construction and assumes 10 hr. days		
Based on Garter snake restriction only about half of the period is available for excavation		
Pipe volume equals about 20% of the total excavation quantity		
If we assume 80% scraper excavation & 10 hr. days, time for 22 scrapers is: 485 days		
If dumps used for remaining 10%, 10 trucks could handle the volume in about 400 days		
Assuming use of dump trucks to supplement haul:		
Assume max use of scrapers per spreadsheet	1,928,000.00	Remaining yards
Dump Trucks	10.00	CY
Cycle time 30 minutes	16.00	Trips per day
Same site, 50 trucks listed	241.00	Days required
Spreadsheet shows	200.00	Days
Assuming use of off road trucks(no dumps)20 CY		
Assume max use of scrapers per spreadsheet	1,928,000.00	Remaining yards
Truck Capacity	20	CY
With 8 hr. day & 40 minute cycle time	12	loads per day

Does not fit DWR time line

Does not fit

Same site 50 trucks listed	161	Days required	OK
Spreadsheet shows	330.00	Days	

Backfill Items		
Compacted Backfill, Delevans pipe	1,200,000	CY
Common Backfill, Delevans pipe, 1/2 mi haul	2,000,000	CY
Compacted Backfill, TRR pipe	200,000	CY
Common Backfill, TRR pipe, 1/2 mi haul	300,000	CY
Total	3,700,000	
Assume Scrapers for common, 25 CY	92,000	Loads
Work day per spreadsheet	10	hours
Assumed cycle time	20	minutes
Cycles per day	30	Cycles
Calculated scraper days	3,067	Scraper days
Spreadsheet Scraper number	16	Scrapers
Calculated scraper duration	191.67	Work Days
Spreadsheet shows	330	Work Days
Assume dump trucks for compacted BF, 10 CY	140,000	Loads
Work day per spreadsheet	10	hours
Assumed cycle time	20	minutes
Cycles per day	30	Cycles
Calculated Truck Days	4,667	Truck days
Spreadsheet Truck Count	10	
Calculated Truck duration	467	Days
Spreadsheet shows	330	Days

Total calculated off-road truck days -Exc. + BF	627	Days @ 50 trucks
Table off-road truck days	330	Days @ 50 trucks

Clear And Grubb

Total all areas	135	Acres
Total For access	15	Acres

Clear & grub	1	Acre/day/dozer
Dozer duration	150	Work Days
Allowed dozer count	4	Dozers
Calculated duration	38	Work days

Concrete		
Concrete encase pipe, Delevans	4,000	CY
Concrete encase pipe, TRR	2,000	CY
	6,000	CY
Using road limit 9 CY trucks	667	Truck loads
Assuming one hour cycle time, 8 loads per day	83	Truck days
Concrete trucks per DWR spreadsheet	20	
Using 20 trucks per DWR spreadsheet	4	Work days
Spreadsheet shows	330	Days

On site batch plant

Concrete dry materials	3700	LB/Cy
Total quantity	11,100	Tons
Assumed truck load	20000	LB/truck
Total loads	1,110	Loads
Assumed loads per day	5	loads/day
Truck count assumed	8	Trucks
Calculated Work days	28	Work days

Other Trucking		
Rebar, Delevans 4% by Weight	320	Tons
Rebar, TRR 4% by Weight	160	Tons
Total	480	Tons
Allowing 20 T per load	24	Truck days
Using 10 Trucks	2	Days at 10 trucks
Other highway trucking		
Manholes 60 ea. @ 2 per load	30.0	Trips
Allow for Vacuum siphon structure	20.0	Trips

	Total	50	Trips
Assume 1 trip per day per truck		50	Trucks
Using 10 Trucks		5.0	Days at 10 trucks

Pipe Fabrication			
Delevans 12' Dia	140,000	LF	
TRR 12' Dia	25,000	LF	
	Total	165,000	LF
Pipe Wall Thickness	12	inches	
Concrete Volume	249,456	CY	
Concrete dry materials Weight/tons	461,493	Tons	
Highway truck load assumed	25	Tons	
Total loads	18,460	Loads	
Using 35 mile one way trip assume cycle time	2	Hours	
Work Day assumed to be	10	Hours	
Cycles per day	5		
Truck quantity	10		
Delivery days for concrete dry materials	369	Days at 10 trucks	
Pipe rebar assumed at 5% by Weight	23,075	Tons	
With similar assumptions to above	923	Loads	
Delivery days	18	Days at 10 trucks	
Gasket materials 1 set per 10 LF of pipe	16,500	Sets	
Assume sets per truck	200	Sets	
Assume cycles per day	2	cycles/day/truck	
Calculated total truck days	41	truck days	
Delivery days	4	Days at 10 trucks	

Allow for setup and miscellaneous	100	Days at 10 trucks
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Delivery of equipment - Allow

200 Truck days

Revision for spreadshhet

20 Days at 10 trucks

Highway Truck totals		
Using indicated 50 trucks		
Total highway truck days per calculation	499	Days at 10 trucks
Total high truck days per spreadsheet	18250	Truck Days

Pipe from yard to installation		
Total pipe footage	165,000	LF
Allowed time for installation	500	Days
Assumed pipe length	10	Ft/Section
Approx. weight for one 10' section	30	Tons
Total number of sections	16,500	Sections
Assumed max time allowed for delivery	600	Days
Truck cycle time	40	minutes
Work day	10	hours
Deliveries per day	15	loads
Assuming two trucks	550	Days with 2 trucks

In all cases, the number of vehicles is likely to be based on project schedule and optimal equipment utilization.
The intent of this effort is to identify probable total equipment operation hours.

Pipelines - Delevans and TRR

Equipment	Excavation			Backfill			Pipe & Manhole Installation			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Backfill Loader				2	467	934			-	934
Bulldozer	4	538	2,152	2	467	934			-	3,086
Compactor	-		-	2	467	934			-	934
Conc. Material trucks							8	28	224	224
Concrete Trucks			-	-	-	-	1	83	83	83
Crane Fabrication							1	1,000	1,000	1,000
Crane Installation							1	500	500	500
Dump truck 20% Exc.	10	400	4,000	-		-			-	4,000
Dump truck Comp. BF	-			10	467	4,670			-	4,670
Excavation Loader	1	400	400	-		-			-	400
Excavator	1	400	400	-		-			-	400
Fork Lift - Installation							1	500	500	500
Fork Lift - Yard							1	1,000	1,000	1,000
Fuel Truck	1	500	500	1	467	467			-	967
Generator	1	500	500	1	83	83			-	583
Grader			-	1	467	467			-	467
Highway Trucks	10	20	200			-	10	499	4,990	5,190
Jacking Equipment	-	-	-	-	-	-	1	600	600	600
Pipe Fabrication Equip.							1	1000	1000	1000
Pipe transport truck							2	550	1,100	1,100
Scraper 80% EXC.	22	485	10,670	-		-			-	10,670
Scraper Common BF	-			8	383	3,064			-	3,064
Water Trucks	1	500	500	1	467	467			-	967
Staff	61			43			37			

Recreation Facilities

Excavation	69,391	CY
Dump Truck Capacity	10	CY
Truck loads	6,939	Loads
Cycle time assumed	30	Minutes
Loads per 10 hour day	20	per day
Total dump truck days	347	Dump Truck days
Assumed Truck Quantity	3	Dump Trucks
Required work Days	116	Work Days

Backfill Items		
Backfill all items	20,171	CY
Total	20,171	CY Total
Assume dump Trucks	10	CY
Required loads	2,017	Loads
Assume 30 minute cycle time, 8 hr.	16.00	Trips per day
Truck Count assumed	3.00	Dump Trucks
Time required	42	Work Days

Gravel Import		
Gravel all locations	21296	CY
Gravel Roads assumed 6" thick	9362	CY
Gravel Spurs+walks	5907	CY
Highway trucks - 12 cy	492	Loads
Assuming 40 minute cycle time, 8 hr.	12	loads/day/truck
Truck days	41	Truck days
Truck count assumed	4	Trucks
Using spreadsheet count	10	Work days

Clear And Grubb		
Total all areas	42.7	Acres
Total For Roads	7	Acres
Clear & grub	0.5	Acre/day/dozer
Dozer duration	100	Work Days

Small Graded Areas	105472	SF
Allow Bobcat	4000	SF/day
Bobcat Days	26	Work Days

Note: This equipment likely for broad use on this type of work.

Aggregate Base	14,190	Tons
Assume 1.6 T/Cy	8,869	CY
Assume use of dump trucks		
Dump truck capacity	10	CY/Load
Total Dump truck loads	887	Loads
Assume processing facility on site and 25 mile max		
Assume cycle time	75	minutes
Trips per 10 hr. day	8	Trips/day
Total dump truck days	111	Truck days
Assume trucks for work	4	Trucks
Work Days	28	Work Days

Asphalt	6,903	T
Asphalt roads & pads	325180	SF
Assume 1.6 T/Cy	-	CY
Assume use of dump trucks		
Dump truck capacity	10	CY/Load
Total Dump truck loads	690	Loads

Assume processing facility within 25 miles		
Assume cycle time	75	minutes
Trips per 10 hr. day	8	Trips/day
Total dump truck days	86	Truck days
Assumed truck count	4	Trucks
Calculated dump truck days	22	truck days

Concrete Items

Box Culvert Siphon		
Boat launch	4746	Cy
Total Concrete	4746	CY
Reinforcing assumed at 4%	380	Tons

Concrete Trucks

Using road limit 9 CY trucks	527	Truck loads
Assuming one hour cycle time, 8 loads	66	Truck days
Concrete trucks assumed	2	Trucks
Calculated work days	33	Work days

On site batch plant

Concrete dry materials	3700	LB/Cy
Total quantity	8,780	Tons
Assumed truck load	20000	LB/truck
Total loads	878	Loads
Assumed loads per day	5	loads/day
Truck count assumed	4	Trucks
Calculated Work days	44	Work days

Highway trucks

Rebar @ 15,000/load	51	Loads
Assumed loads/day	2	loads/day
Assume truck count	2	trucks
Calculated work days	13	Work Days
Heavy Equipment moving	40	Work Days
Picnic tables	10	Work Days
Barbeques	10	Work Days
Vault toilets	5	Work Days
Dumpsters	12	Work Days
Parking stops	4	Work Days
Bathrooms & HB plumbing	20	Work Days
Septic tanks	9	Work Days
Dock area	10	Work Days
Shade Canopies	2	Work Days
SWPPP materials	2	Work Days
Weed Barrier	1	Work Days
Calculated days for two trucks	121	Work Days

281
277
17
51
512
9
10

Recreation Facilities

Equipment	Grading & Paving			Concrete Work			Miscellaneous			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Bobcat	2	158	316							316
Bulldozer	1	116	116			-			-	116
Compactor			-			-			-	-
Concrete Trucks			-	2	33	66			-	66
Concrete Material trucks			-	4	44	176			-	176
Crane			-			-			-	-
Drilling machine			-			-			-	-
Dump truck	3	158	474			-			-	474
Excavator			-			-			-	-
Fork Lift - Yard			-			-	1	121	121	121
Fuel Truck	1	158	158	1	33	33	1	121	121	312
Generator			-	1	33	33			-	33
Grader	1	28	28			-			-	28
Grout Pump			-			-			-	-
Highway Trucks	4	10	40			-	2	121	242	282
Loader	1	158	158			-			-	158
Off-Road Trucks			-			-			-	-
Paving Machine	1	22	22			-			-	22
Roller	1	50	50			-			-	50
Scraper - Excavation			-			-			-	-
Water Trucks	1	144	144			-			-	144
Staff Max	24		-	18		-	14		-	-
			-			-			-	-

Paved Roads & Bridges

Includes only work description included with Sites Pumping plant and tunnel estimate

Excavation

Scraper cut & move	2,736,969	CY
Scraper capacity	25	CY
Scraper loads	109,479	Loads
Cycle time assumed	20	Minutes
Loads per 10 hour day	30	per day
Total scraper days	3,649	scraper days
Assumed Scraper Quantity	16	Scrapers
Required work Days	228	Work Days

Rock Cut	1,368,484	CY
Scraper Capacity reduced for rock	20	CY
Assume 50% removable with scrapers	34212	Loads
Cycle time assumed	30	Minutes
Loads per 10 hour day	20	per day
Total scraper days	1,711	scraper days
Assumed Scraper Quantity	16	Scrapers
Required work Days	107	Work Days
Off Road Truck Capacity reduced for rock	15	CY
Assume 50% removable with scrapers	91232	Loads
Cycle time assumed	30	Minutes
Loads per 10 hour day	20	per day
Total Off-road truck days	4,562	Truck days
Assumed Truck Quantity	20	Trucks
Required work Days	228	Work Days
Based on soil description, rock should be rippable.		

Compacted fill - assume minimal relocation	2,537,547	CY
Scraper capacity	25	CY
Scraper loads	101,502	Loads
Cycle time assumed	20	minutes
Loads per 10 hour day	30	per day
Total scraper days	3,383	scraper Days
Assumed Scraper Quantity	16	Scrapers
Required work Days	211	Work Days
Total work days for sixteenscrapers	546	Work Days

Aggregate Base & subbase	703,076	Tons
Assume 1.6 T/Cy	439,423	CY
Assume use of dump trucks		
Dump truck capacity	10	CY/Load
Total Dump truck loads	43,942	Loads
Assume processing facility on site and 25 mile max		
Assume cycle time	75	minutes
Trips per 10 hr. day	8	Trips/day
Total dump truck days	5,493	Truck days
Assume trucks for work	20	Trucks
Work Days	275	Work Days

Asphalt	103,546	T
Assume 1.6 T/Cy	64,716	CY
Assume use of dump trucks		
Dump truck capacity	10	CY/Load
Total Dump truck loads	6,472	Loads
Assume processing facility within 25 miles		
Assume cycle time	75	minutes
Trips per 10 hr. day	8	Trips/day
Total dump truck days	809	Truck days
Assumed Truck Count	20	Trucks
Calculated work days	40	Work Days

Clear & Grub activities

Allowed area	444	Acres
Assumed production	1	acre/day/dozer
Assumed number of dozers	12	Dozers
Days required	37	Work Days
Cleared Area	444	Acres
Assumed Loads per cleared area	4	loads/acre
total dump truck loads	1,776	
Assumed cycle time	80	minutes
work day	8	hours
Cycles/day	6	
Total truck days	296	
Assumed truck count	10	
Work days	30	

Culverts 6' Diameter	2,300	LF
Delivery Trucks @ 30 LF/load	77	Loads
Assumed trucks	2	Trucks
Cycle time assumed	4	hrs
Required time	19	Work Days

Fencing	89	Miles
Drill posts @ 10' OC	46,992	EA
Assume 4 holes / hr	32	holes/day
Calculated time for the work	1,469	days
Assumed backhoe/drills	6	Rigs
Calculated work days	245	Work Days
Haul Fence assumed load	2,000	LF/Truck
Total loads	235	Loads

Bridges

Grade & Excavate Abutments

Assume 60'wideX30'deepX100'long 15,000 CY

Bulldozer

Loader

Dump trucks

Assumed Load size	10	CY
total dump truck loads	1,500	Loads
Assumed cycle time	30	minutes
work day	8	hours
Cycles/day	16	Cycles/day
Total truck days	94	Truck Days
Assumed truck count	5	Trucks
Work days	19	Work Days

Pier Foundation Excavaion

Drawing shows 21 EA - Use 60'X20'X10' 10,000 CY

Excavator

Loader

Dump Trucks

Assumed Load size	10	CY
total dump truck loads	1,000	Loads
Assumed cycle time	30	minutes
work day	8	hours
Cycles/day	16	Cycles/day
Total truck days	63	Truck Days
Assumed truck count	5	Trucks
Work days	13	Work Days

Caissons		
Assume 40'deep and 20 caissons per pier	16,800	LF
Drill Rig for deep piers @ 2 caissons/day	210	Work Days
Assumed Rigs	2	Rigs
Duration	105	Work Days
Caisson Waste @ 24" diameter	2,000	CY

Dump Trucks		
Assumed Load size	10	CY
total dump truck loads	200	Loads
Assumed cycle time	30	minutes

work day	8	hours
Cycles/day	16	Cycles/day
Total truck days	13	Truck Days
Assumed truck count	5	Trucks
Work days	3	Work Days

Concrete Work

Caisson Concrete	2,000	CY
Assume Concrete Reinforcing @ 4%	160	Tons
Support Frames scale about 3600 LF		
Assume 10 CY concrete per LF	36,000	CY
Bridge desk 1.6 milesX50'wide use 4' ave depth	62,600	CY
Assume Concrete Reinforcing at 6%	11,800	Tons
Total Concrete	100,600	CY
Total Reinforcing	11,960	Tons

Concrete Trucks		
Using road limit 9 CY trucks	11,178	Truck loads
Assuming one hour cycle time, 8 loads per day	1,397	Truck days
Concrete trucks assumed	10	Trucks
Calculated work days	140	Work days

On site batch plant

Concrete dry materials	3700	LB/Cy
Total quantity	186,110	Tons
Assumed truck load	20000	LB/truck
Total loads	18,611	Loads
Assumed loads per day	5	loads/day
Truck count assumed	12	Trucks
Calculated Work days	310	Work days

Crane

Highway trucks

Trucks for rails, embeds & signage 1/100LF	84	Loads
Equipment trucking Allow	80	Work Days
Highway trucks for formwork gross assumption	100	work days
Highway trucks for Rebar @ 15,000 lb/truck	1,595	Loads
Assumed Loads/day	2	loads/day
Assumed truck count	12	Trucks
Total work days	66	work days
Calculated work days using 12 trucks	88	

Concrete pump

Generator for Vibrators, etc
Miscellaneous
Generator for tools

Other equipment		
Loader		
Loader time for agg base & asphalt	315	Work days
At a load time of about 5 minutes requires	2	Loaders
Spreadsheet includes	1,095	Loader days
Bulldozer		
Estimated for Clear & Grubb	37	Work days
Required during excavation	563	Work Days
Assume required during compacted fill period	211	Work Days
Allow for use during agg base installation		Work days
Total	812	Work days

Compactor		
Required during excavation	-	Work days
Required during compacted fill period	211	Work days
Required during agg base installation		Work days
Total	211	Work days
Allow four compactors	846	Compactor days

Paved Roads & Bridges

Equipment	Grading			Agg Base & Paving			Bridges			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Backhoe/drill				6	245	1,470	0	0	-	1,470
Caisson Drill Rig							1	105	105	105
Bulldozer	12	811	9,732			-	2	19	38	9,770
Compactor			-			-			-	-
Concrete Trucks			-	4	211	846	10	140	1,400	2,246
Concrete material trucks							12	310	3,720	3,720
Concrete Pump							2	140	280	280
Crane			-			-	2	500	1,000	1,000
Drilling machine			-			-			-	-
Dump truck	10	30	300	20	315	6,300	5	35	175	6,775
Excavator			-			-	2	13	26	26
Fork Lift - Yard			-			-			-	-
Fuel Truck	1	811	811	1	315	315			-	1,126
Generator			-			-	1	500	500	500
Grader	4	211	844	4	315	1,260			-	2,104
Grout Pump			-			-			-	-
Highway Trucks			-	1	235	235	12	88	1,056	1,291
Loader	2	285	570	2	315	630	1	35	35	1,235
Off-Road Trucks	20	228	4,560			-			-	4,560
Paving Machine			-	2	40	80			-	80
Roller	4	211	844	2	40	81			-	925
Scraper	16	546	8,736			-			-	8,736
Water Trucks	2	811	1,622	2	315	630			-	2,252
Staff Max	81		-	48		-	59		-	-
			-			-			-	-

Sacramento River Intake & P/G Plant

Excavation Items		
Excavation, pump station - 8.5 mi haul	400,000	CY
Total	400,000	CY

Assume 50% by scrapers 200,000 CY

Assume scrapers, 25 CY	8,000	Loads
With 8 hr. day & 40 minute cycle time	12	loads per day
	667	Loader days
Scraper count assumed	5	
Time required	133	Days
Spreadsheet shows	160.00	Days

Assuming use of dump trucks to supplement haul:

50% of total quantity	200,000	CY
Dump Trucks Capacity	10.00	CY
Dump truck loads required	20,000.00	Loads
Cycle time 30 minutes, 8 hour day	16.00	Trips per day
Assumed load time	3	minutes
Truck Count assumed	10.00	Trucks
Same site, 5 trucks listed	125.00	Days required
Spreadsheet shows	200.00	Days

1 loader

Backfill Items		
Backfill, pump station 1/2 mi haul	200,000	CY
Total	200,000	CY Total
Assume scrapers	25	CY
Required loads	8,000	Loads
Assume 30 minute cycle time, 8 hr. day	16.00	Trips per day
Scraper Count assumed	5.00	Scrapers
Time required	100.00	Work Days
Spreadsheet shows	200	Days

insufficient

About 6 required for this duration

Concrete		
Concrete, PG plant	30,000	CY
	30,000	CY
Using road limit 9 CY trucks	3,333	Truck loads
Assuming one hour cycle time, 8 hour day	8	loads/day/truck
Truck days	417	Truck days
concrete truck count assumed	4	
Calculated work days	104	Work days
Spreadsheet shows	250	Days

On site batch plan

Concrete dry materials	3700	LB/Cy
Total quantity	55,500	Tons
Assumed truck load	20000	LB/truck
Total loads	5,550	Loads
Assumed loads per day	5	loads/day
Truck count assumed	8	Trucks
Calculated Work days	139	Work days

Allow for plant setup and removal

8X3 Truck days

Spreadsheet work days	160	Days
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Other Trucking		
Rebar, Delevans 4% by Weight	2400	Tons
Structural Steel - Delevans	125	Tons
Steel pipe & manifolds, Delevans	1000	Tons
Total	3525	Tons
Allowing 20 T per load	176.25	Truck days
Truck count assumed	8	Trucks
Using spreadsheet count	22	Work days
Spreadsheet work days	160	Days
Miscellaneous Trucking		
Fencing and gates	5	Trips
Seeding	2	Trips
Dewatering pump delivery & removal	2	Trips
Jacking equipment delivery & removal	2	Trips
Pumps - 4 EA	4	Trips
Kaplan turbines - 2 EA	6	Trips
Valves & Discharge - 4 EA	8	Trips
Sleeve Couplings - 8	4	Trips
100 cfs pump	1	Trips
36" BFS - 3 EA	2	Trips
150 T crane	5	Trips
32' Air Chambers - 4 EA	8	Trips
Mechanical Auxiliary	20	Trips
Generator	1	Trips
Compressor	1	Trips
Conduit/cables & "features"	20	Trips
Switchyard Equipment	10	Trips
Transformers	4	Trips
Miscellaneous for building & equipment	300	Trips
Total	405	Trips
Using standard 8 trucks	51	Work days
Assume all trips represent one full day		

Highway Truck totals		
Using indicated 50 trucks		
Total highway truck days per calculation	566	Truck Days
Total highway truck days per spreadsheet	1000	Truck Days

Sacramento River Intake & P/G Plant

Equipment	Excavation & Backfill			Concrete & Rock			Other Activities			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Batch plant equipment			-	1	104	104			-	104
Bulldozer	5	233	1,165			-			-	1,165
Compactor	2	100	200			-			-	200
Concrete Pump			-	1	104	104			-	104
Concrete Trucks			-	4	104	416			-	416
Crane	-		-	-		-	1	200	200	200
Drilling machine			-			-			-	-
Dump truck	10	125	1,250			-			-	1,250
Excavator			-			-			-	-
Fork Lift			-			-	1	400	400	400
Fuel Truck	1	233	233			-	1	100	100	333
Generator			-	1	104	104			-	104
Grader	2	100	200			-			-	200
Highway Trucks			-	8	147	1,176	8	73	584	1,760
Loader	1	125	125			-			-	125
Off-Road Trucks			-			-			-	-
Paving Machine			-			-			-	-
Roller			-			-			-	-
Scraper - Excavation & BF	5	233	1,165			-			-	1,165
Water Trucks	2	233	466			-			-	466
Staff Max	38		-	25		-	101		-	-

Peak staff for other activities is set at 80 for building construction. Duration for buildings should be about two years.

Transmission Lines

Length 13 Miles
68640 Feet

Tower Spacing 1200 Ft
Assumed number of towers 58
Assumed tower footing 20X20X10'
Total Excavation 8700 CY

Excavator 1 Footing/day
Total Days 58 Work Days

Dump Trucks	10	CY/truck
Total Loads	870	loads
Assumed cycle time	1	Hr
Cycles/work day	10	Cycles
Assumed number of trucks	2	Trucks

Concrete

Concrete Fill	8700	CY
Concrete truck capacity	9	CY
total loads	967	Loads
Capacity per truck per day	90	CY
Assume pour 2 ftgs/day	300	CY
use 4 trucks	29	

On site batch plant

Concrete dry materials	3700	LB/Cy
Total quantity	16,095	Tons
Assumed truck load	20000	LB/truck
Total loads	1,610	Loads
Assumed loads per day	5	loads/day

Truck count assumed	8	Trucks
Calculated Work days	40	Work days

Towers

Anchor Bolts & reinforcing		
Allow highway truck	1	day/tower
Tower Steel	2	days/tower
Cable	1	day/tower
forklift	1	unit
Erection Crane	2	days/tower
Spool truck - assume dump size	1	EA
Assume boom trucks	2	EA
Pull cable with cat	1	Ea
assume duration	120	days

Equipment	Excavation			Concrete Work			Towers			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Bobcat										
Boom Truck							2	120	240	240
Bulldozer			-			-	1	120	120	120
Compactor			-			-			-	-
Concrete Trucks			-	4	29	116			-	116
Concrete Material trucks										
Crane			-			-	1	116	116	116
Drilling machine			-			-			-	-
Dump truck	2	58	116			-	1	120	120	236
Excavator	1	58	58			-			-	58
Fork Lift			-			-	1	116	116	116
Fuel Truck	1	58	58	1	29	29	1	116	116	203
Generator			-	1	29	29			-	29
Grader			-			-			-	-
Grout Pump			-			-			-	-
Highway Trucks			-	8	40	320	2	116	232	552
Loader	1	58	58			-			-	58
Off-Road Trucks			-			-			-	-
Paving Machine			-			-			-	-
Roller			-			-			-	-
Scraper - Excavation			-			-			-	-
Water Trucks	1	58	58			-			-	58
Staff Max	11		-	19		-	12		-	-
			-			-			-	-

TRR Reservoir

Short haul excavation is likely to be by scrapers

Longer hauls assume to be with off-road trucks

Excavation assume 8.5 mile average haul	1,300,000	CY
Assume 30% Scrapers	390,000	CY
Assume 70% trucks	910,000	CY
Scraper portion		
Scraper portion capacity	25	CY
Scraper loads	15,600	Loads
Assume scraper cycle time	20	minutes
Scraper loads per 10 hour day	30	Loads
Total scraper days	520	Scraper Days
Assumed Scraper Count	4	Scrapers
Calculated work days	130	Work Days
Spreadsheet includes 4 EA X 365 days	1,460	Scraper Days
Truck portion		
Capacity for off-road trucks	20	CY
Total number of off-road truck loads	45,500	Loads
Assume truck cycle time	30	Minutes
Truck loads per 10 hour day	20	Loads
Total off-road truck days	1,517	Truck Days
Assume Truck Count	10	Trucks
Calculated Work Days	152	Work Days
Spreadsheet off-road trucks 15 EA X 365 days	5,475	Truck Days

Clear & Grub	200	Acres
Assumed production	1	Acre/day/dozer
Dozer Count	4	Dozers
Work Duration	50	Work Days

BACKFILL		
Backfill quantity	100,000	CY
Scraper portion capacity	25	CY
Scraper loads	4,000	Loads
Assume scraper cycle time	20	minutes
Scraper loads per 10 hour day	30	Loads
Total scraper days	133	Scraper Days
Assumed Scraper Count	4	Scrapers
Calculated work days	33	Work Days
Spreadsheet includes 4 EA X 365 days	1,460	Scraper Days

Highway trucking		
AC lining - approx. 500 loads, 2 hr. cycle time	100	Truck days
Allow for diversion structure	500	Truck days
Allow for overflow structure	100	Truck days
Total	700	Truck days
Trucks assumed	5	Trucks
Calculated truck days	140	
Spreadsheet allows 20 trucks for 365 days	7,300	Truck days

Other Equipment

Bulldozers		
Excavation - match scraper excavation days	520	Dozer Days
Backfill - match scraper days	133	Dozer Days
Total	653	Dozer Days
Spreadsheet allows 2EA X 365 days	730	Dozer Days

Compactor		
Backfill - match scraper days	133	Compactor Days
Spreadsheet allows 2EA X 365 days	730	Compactor Days

TRR Reservoir

Equipment	Clear & Excavation			Backfill			AC Lining & Structures			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Backfill Loader			-			-			-	-
Bulldozer	4	180	720	4	33	132			-	852
Compactor			-	2	33	66			-	66
Concrete Trucks			-			-			-	-
Crane			-			-			-	-
Drilling machine			-			-			-	-
Dump truck			-			-			-	-
Excavation Loader	1	152	152			-			-	152
Excavator			-			-			-	-
Fork Lift - Yard			-			-	1	140	140	140
Fuel Truck	1	152	152	1	33	33			-	185
Generator			-			-			-	-
Grader			-	1	33	33			-	33
Grout Pump			-			-			-	-
Highway Trucks			-			-	5	140	700	700
Off-Road Trucks	10	152	1,520			-			-	1,520
Paving Machine			-			-	1	20	20	20
Scraper - Excavation	4	130	520	4	33	132			-	652
Water Trucks	1	182	182	1	33	33			-	215
			-			-			-	-
Staff	31			23			57			-

Staff allowed for structures is 40 for a period of 16 months

TRR Pump Plant

Excavation Items		
Excavation, pump station - 8.5 mi haul	400,000	CY
Total	400,000	CY
Assume 50% by scrapers	200,000	CY

Assume scrapers, 25 CY	8,000	Loads
With 8 hr. day & 40 minute cycle time	12	loads per day
	667	Loader days
Scraper count assumed	5	
Time required	133	Days
Spreadsheet shows	160.00	Days
Assuming use of dump trucks to supplement haul:		
50% of total quantity	200,000	CY
Dump Trucks Capacity	10.00	CY
Dump truck loads required	20,000.00	Loads
Cycle time 30 minutes, 8 hour day	16.00	Trips per day
Assumed load time	3	minutes
Truck Count assumed	10.00	Trucks
Same site, 5 trucks listed	125.00	Days required
Spreadsheet shows	200.00	Days

1 loader

Backfill Items		
Backfill, pump station 1/2 mi haul	200,000	CY
Total	200,000	CY Total
Assume scrapers	25	CY
Required loads	8,000	Loads
Assume 30 minute cycle time, 8 hr. day	16.00	Trips per day
Scraper Count assumed	5.00	Scrapers
Time required	100.00	Work Days
Spreadsheet shows	200	Days

insufficient

About 6 required for this duration

Concrete		
Concrete, PG plant	30,000	CY
	30,000	CY
Using road limit 9 CY trucks	3,333	Truck loads
Assuming one hour cycle time, 8 hour day	8	loads/day/truck
Truck days	417	Truck days
concrete truck count assumed	4	
Calculated work days	104	Work days
Spreadsheet shows	250	Days

On site batch plan

Concrete dry materials	3700	LB/Cy
Total quantity	55,500	Tons
Assumed truck load	20000	LB/truck
Total loads	5,550	Loads
Assumed loads per day	5	loads/day
Truck count assumed	8	Trucks
Calculated Work days	139	Work days

Allow for plant setup and removal

8X3 Truck days

Rock Import		
Stone Slope protection, 10 mile haul	10000	Tons
Total	10000	Tons
Use 1.6CY/Ton	6250	CY
Highway trucks - 12 cy	521	Loads
Assuming 40 minute cycle time, 8 hour day	12	loads/day/truck
Truck days	43	Truck days
Truck count assumed	8	Trucks
Using spreadsheet count	5	Work days
Spreadsheet work days	160	Days

Other Trucking		

Rebar, Delevans 4% by Weight	2400	Tons
Structural Steel - Delevans	125	Tons
Steel pipe & manifolds, Delevans	1000	Tons
Total	3525	Tons
Allowing 20 T per load	176.25	Truck days
Truck count assumed	8	Trucks
Using spreadsheet count	22	Work days
Spreadsheet work days	160	Days
Miscellaneous Trucking		
Fencing and gates	5	Trips
Seeding	2	Trips
Dewatering pump delivery & removal	2	Trips
Jacking equipment delivery & removal	2	Trips
Pumps - 4 EA	4	Trips
Kaplan turbines - 2 EA	6	Trips
Valves & Discharge - 4 EA	8	Trips
Sleeve Couplings - 8	4	Trips
100 cfs pump	1	Trips
36" BFS - 3 EA	2	Trips
150 T crane	5	Trips
32' Air Chambers - 4 EA	8	Trips
Mechanical Auxiliary	20	Trips
Generator	1	Trips
Compressor	1	Trips
Conduit/cables & "features"	20	Trips
Switchyard Equipment	10	Trips
Transformers	4	Trips
Miscellaneous for building & equipment	300	Trips
Total	405	Trips
Using standard 8 trucks	51	Work days
Assume all trips represent one full day		

TRR Pump Plant

Equipment	Excavation & Backfill			Concrete & Rock			Other Activities			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Batch plant equipment			-	1	104	104			-	104
Bulldozer	5	233	1,165			-			-	1,165
Compactor	2	100	200			-			-	200
Concrete Pump			-	1	104	104			-	104
Concrete Trucks			-	4	104	416			-	416
Crane	-		-	-		-	1	200	200	200
Drilling machine			-			-			-	-
Dump truck	10	125	1,250			-			-	1,250
Excavator			-			-			-	-
Fork Lift			-			-	1	400	400	400
Fuel Truck	1	233	233			-	1	100	100	333
Generator			-	1	104	104			-	104
Grader	2	100	200			-			-	200
Highway Trucks			-	8	147	1,176	8	73	584	1,760
Loader	1	125	125			-			-	125
Off-Road Trucks			-			-			-	-
Paving Machine			-			-			-	-
Roller			-			-			-	-
Scraper - Excavation & BF	5	233	1,165			-			-	1,165
Water Trucks	2	233	466			-			-	466
Staff Max	38		-	25		-	101		-	-

Peak staff for other activities is set at 80 for building construction. Duration for buildings should be about two years.

Tunnel - Inlet and Outlet Including Sites Pump Plant

Tunnel is approximately 4,000 LF

Material is sandstone and mudstone. Tunneling should proceed quickly.

Tunnel bore diameter is approximately 33'.

Tunnel waste volume calculates as 126,650 CY

Gate shaft structure is approximately 250 LF 8,000 CY

Rate of tunnel progress assumed to be 20-40 LF/Day

This equates to a total tunneling duration of 100 to 200 days. 1266.5

This would result in about 600 to 1200 CY/day -

Boring machine would run up to 22 hrs. /day

DWR table allows 400 days for boring machine.

Assuming 20 CY dumps this would mean about 63 trips per day

Assuming 40 CY off-road trucks this is about 32 trips per day

Using 10 hour work day per DWR tables and approximate 30 minute cycle time:

Tunnel hauling would require about 3 dump trucks or 2 off road trucks

Excavation		
Tunnel Excavation per spreadsheet	140,000	CY
Shaft Excavation per spreadsheet	4,900	CY
Haul distance	2	Miles
Assume dump trucks	10	CY/EA
total number of trips	14,490	Trips
Cycle time (Ave)	30	minutes
Work hours per day	22	
Truck trips per day	44	
Assumed number of trucks	3	
Number of work days	110	

Tunnel concrete		
Non-reinforced	37000	CY
Shaft Concrete	1900	CY
Reinforced	3000	CY
Total	41900	

Using road limit 9 CY trucks	4,656	Truck loads
Assuming one hour cycle time, 8 loads per day	582	Truck days
Using 3 trucks per DWR spreadsheet	194	Work days
Spreadsheet shows	600	Days

On site batch plant

Concrete dry materials	3700	LB/Cy
Total quantity	77,515	Tons
Assumed truck load	20000	LB/truck
Total loads	7,752	Loads
Assumed loads per day	5	loads/day
Truck count assumed	8	Trucks
Calculated Work days	194	Work days

Highway trips		
Rock Bolts 205,000 LF @ 4LBS/FT	410	Tons
Structural Steel Supports	483.5	Tons
Steel Liner	1925	Tons
Reinforcing steel @ 4% by Weight	392	Tons
Grout material 3000 sacks	141	Tons
Total	3351	Tons
Assumed truck load	20	Tons
Total number of loads	168	Loads
allowance for misc. loads	100	loads
Trucks anticipated	5	EA
Haul Days	54	Days

In reservoir excavation

Estimate allows 323,000 CY

Work can be concurrent with tunnel excavation

Work must be completed to complete tunnel, e.g., less than 200 days after tunnel start

While scrapers would seem the optimal equipment, off-road trucks seem to be used in spreadsheets

Excavation as shown		
In lake excavation	323,000	CY
Bridge pier excavation	261	CY
Off-road trucks	20	CY
	16,163	Truck loads
Haul distance assumed 2 mi	20	minutes/cycle
Cycles per 10 hour day	30	
Assume	10	Trucks
Work days	54	Days

Excavation as anticipated with scrapers		
In lake excavation	323,000	CY
Bridge pier excavation	261	CY
Scrapers	25	CY
	12,930	Scraper loads
Haul distance assumed 2 mi max	20	minutes/cycle
Cycles per 10 hour day	30	
Assume	5	Scrapers
Work days	86	Days

Outlet Concrete		
Tower Concrete	2500	CY
Bridge pier concrete	580	CY
Bridge light wt. concrete	165	CY
Gate Transition Concrete	5000	CY
Total	8245	
Using road limit 9 CY trucks	916	Truck loads
Assuming one hour cycle time, 8 loads per day	115	Truck days
Assumed truck quantity - 4 EA	29	Work days
Spreadsheet shows	600	Days

On site batch plant

Concrete dry materials	3700	LB/Cy
Total quantity	15,253	Tons
Assumed truck load	20000	LB/truck
Total loads	1,525	Loads
Assumed loads per day	5	loads/day
Truck count assumed	8	Trucks
Calculated Work days	38	Work days

Highway trips		
Trash racks	60	Tons
Fish Screens	24	Tons
Anchor plates	6	Tons
Structural Steel	110	Tons
Bridge Steel	73	Tons
Reinforcing steel	190	Tons
Assumed additional truck load	100	Tons
Total	562	Tons
Assumed truck load size	15	Tons
total number of loads	37	Loads
All loads assumed one full day		
Trucks allowed for calculation	3	EA
Haul Days	12.5	Days
Add haul Days		
Wheel Gates	2.0	Trips
Motor & Electrical	5.0	Trips
Bridge Crane	2.0	Trips
Jib Crane	2.0	Trips
Butterfly Valves 72" X 24 EA	12.0	Trips
Port Thimbles 72" X 2'-6" X 24 EA	6.0	Trips
Aluminum bridge railing	5.0	Trips
Misc.	30.0	Trips
Total	64.0	
All loads assumed one full day		
Trucks for calculation	3	EA

Haul Days	21.3	Days
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Low Intake Site

Estimate Allows 1,996,000 CY

Assume phased to start tunnel work

Initial excavation would be to tunnel excavation level

If tunneling machine used, excavation for power house could not proceed until after tunnel machine removed

While scrapers would seem the optimal equipment, off-road trucks seem to be used

Excavation per spreadsheet			
Low Intake Excavation	1,996,000	CY	
Off-road trucks	20	CY	
	99,800	Truck loads	
Haul distance assumed 2 mi	20	minutes/cycle	
Cycles per 10 hour day	30		
Assume	20	Trucks	
Work days	166	Days	

Excavation as anticipated			
Low Intake Excavation	1,996,000	CY	
Scrapers	25	CY	
	79,840	Scraper loads	
Haul distance assumed 2 mi max	20	minutes/cycle	
Cycles per 10 hour day	30		
Assume	10	Scrapers	
Work days	266	Days	

Low Intake Concrete			
Mass Concrete	20,000	CY	
Structural concrete	2,200	CY	
Saddle dam outlet concrete	300	CY	
Prestressed concrete	1,300	CY	

Total	23,800	
Using road limit 9 CY trucks	2,644	Truck loads
Assuming one hour cycle time, 8 loads per day	331	Truck days
Assumed truck quantity - 4	83	Work days
Spreadsheet shows	600	Days

On site batch plant

Concrete dry materials	3700	LB/Cy
Total quantity	44,030	Tons
Assumed truck load	20000	LB/truck
Total loads	4,403	Loads
Assumed loads per day	5	loads/day
Truck count assumed	8	Trucks
Calculated Work days	110	Work days

Highway trips		
Stop Logs	82	Tons
Cement	10800	Tons
Reinforcing steel	315	Tons
Stiffener Rings	75	Tons
Saddle dam reinforcing steel	18	Tons
Total	11290	Tons
Assumed truck load	15	Tons
total number of loads	753	Loads
All loads assumed one full day		
Trucks assumed	10	EA
Haul Days	75	Days
Other trucking		
Saddle dam culvert pipe 10' Dia. X 250 LF	25	Trips
Misc. allow	20	
Total	45	
All loads assumed one full day		
Trucks assumed	10	EA
Haul Days	5	Days

Summary

Total Calculated Dump Truck days	329	Truck Days
Spreadsheet Dump Truck Days	-	Truck Days
Total Calculated Off-road truck days	3,865	Truck Days
Spreadsheet off-road Truck Days 30X600	18,000	Truck Days
Total Calculated concrete Truck days	916	Truck Days
Spreadsheet concrete truck days 3X600	1,800	Truck Days
Total Calculated Highway Truck Days	5,013	Truck Days
Spreadsheet Highway truck days 30X600	18,000	Truck Days

Tunnel - Inlet and Outlet Including Sites Pump Plant

Equipment	Tunnel			Lake Outlet			Inlet area			Total
	Count	Days	Equip days	Count	Days	Equip days	Count	Days	Equip days	Equip days
Bulldozer			-	5	86	430	5	266	1,330	1,760
Compactor			-			-			-	-
Concrete pump	1	194	194	1	29	29	1	83	83	306
Concrete Trucks	3	194	582	4	29	116	4	83	332	1,030
Crane			-	1	200	200	1	150	150	350
Dump truck Tunnel	3	200	600			-			-	600
Excavator			-			-			-	-
Fork Lift	1	248	248	1	72	72	1	190	190	510
Fuel Truck	1	200	200	1	86	86	1	266	266	552
Generator	1	200	200			-			-	200
Grader			-	1	40	40	2	266	532	572
Highway Trucks	5	54	270	3	34	102	10	80	800	1,172
Loader - tunnel	2	200	400			-			-	400
Material trucks- concrete	8	194	1,552	8	38	304	8	110	880	2,736
Off-Road Truck										
Roller										
Scissor lift	1	100	100			-			-	100
Scraper	-	-	-	5	86	430	10	266	2,660	3,090
Tunnel boring Machine	1	200	200			-			-	200
Water Trucks			-	1	86	86	1	266	266	352
Welding truck	1	194	194	1	50	50	1	50	50	294
			-			-			-	-
Staff	42		-	46		-	59		-	-

All equipment other than tunnels assumed 10 hr. day. Tunnels assumed 22 hours/day.